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Analyzing China Smart Water Meter Industry Cluster Competitiveness

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<p>Sustainable development has always been a top issue nowadays. The smart water management is one of the methods to achieve the sustainable development. This paper aims to focus on analyzing the competitiveness of industrial clusters (Guangzhou, Ningbo and Shanghai) in China specifically to the smart water meter industry. It is part of the CEMIS sourcing work package under the KVTELIOS project with Mr. Al Natsheh Anas, and is supervised by Ms. Komulainen Ruey.</p> <p>Porter Diamond Theory is used as an analytical tool in this paper. It has been adopted by many scholars to analyze national, regional and cluster competitiveness. It provides a guideline and criteria in evaluating the industry cluster competitiveness. Through interviews and data research, it will give some insights to investors; companies; and government on improving their competitiveness.</p>	
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## **PREFACE**

I would like to take this chance to express my gratitude to all of have helped me throughout the thesis writing. They have always been offering me extraordinary support in all aspects.

First, I wanted to say THANK YOU to my supervisor, Ms. Ruey Komulainen. She has been always helping me not just only my thesis, but also my whole study life. It has been so grateful for me to have the valuable chance to meet her and learn from her. Before writing thesis under her supervision, I have learnt a lot with her already as she was my tutor teacher as well. I could make use of the things that I learnt from her before, during the supervision and also in the classes. And this time, I learnt some more new knowledge from her. She has been always so nice to teach to me. I truly thanks for all the things. I am sure that I will definitely remember these memories.

Second, I wanted to say THANK YOU to my commissioner, Mr. Al Natsheh Anas. Without you, I cannot have the chance to write this thesis. Although I do not have the chance to attend your lectures, I am lucky to have the chance to work with you. During the several meetings with you and Ms Ruey, it was as great to me as these valuable learning chances are priceless.

Third, I wanted to say thank you to my two research assistants and my friends. They have helped a lot in the interview work and translation. Hope both of you could learn during the research process and apply them in the future. Also, my friends gave me a lot of support during the past few months. I am so thankful to have them supporting me.

## **1. INTRODUCTION**

### **Aim**

The subject area of this paper is the smart water management which will focus on the smart water meter product type. It aims to focus on analyzing the competitiveness of industrial clusters (Guangzhou, Ningbo and Shanghai) in China specifically to the smart water meter industry. Also, it is part of the CEMIS sourcing work package under the KVTELIOS project with Mr. Al Natsheh Anas, and is supervised by Ms. Komulainen Ruey.

### **Hot Trend in Smart Water Management**

Having reliable water supply is one of the major challenges in sustainable development topics. It has been one of the hottest issues to both developing and developed countries. According to United Nations (UN) General Assembly (2003), the years 2005 to 2015 are the International Decade for Action ‘Water for Life’. Its goal is to make efforts to fulfill international commitments made on water and water-related issues by 2015. Hence, this water resource issue has been a global concern nowadays, which in turn the “Smart Water Management” concept becomes more and more popular. According to the ICT as an Enabler for Smart Water Management Report (2010), it is defined as a strategic process in developing innovative solutions to highlight the water issues as well as facilitating the analysis of environmental data. There are 4 major areas for smart water management: mapping of water resources and weather forecasting, asset management for the water distribution network, setting up early warning systems and meeting water demand and just in time irrigation in agriculture and landscaping.

In the area of early warning systems and meeting water demand, the smart metering technologies can provide individuals or businesses on their water usage information. For instance, water utilities can then use these data to implement intelligent water pricing so as to encourage water conservation. This smart metering technologies are the research area that the



commissioner – CEMIS – is interested in and this paper mainly focuses on the smart water metering.

### **Low-cost manufacturing – China**

China is still the second largest economy in the world, and it is famous for its low-cost manufacturing edge. (China Economy, 2013) According to recent news in Bloomberg, the China Manufacturing Index has rose to a six-month high, 51.2 reading in September 2013. The index indicates the manufacturing economy is expanding if the index is larger than 50, and herein implies there will be a rebound in the world's second largest economy. (Bloomberg, 2013) On the other hand, in China, there are different manufacturing clusters, such as Shanghai, Ningbo and Guangzhou. Each cluster has its own competitive edge and this paper will aim to build a basic profile of each cluster with the use of strategic management tool – Porter Diamond Theory.

## **2. THEORETICAL BACKGROUND**

### **2.1 Smart Water Metering Definition**

In global water industry, smart water metering usually possesses one or all of the features below: (Smart Metering for Water Utilities, 2009)

First, it may refer to interval meters on client's premises that measure water consumption at specific time intervals and the volume of water consumed to that point, such as 15 minutes per interval, and communicates the data back to the utility.

Second, it may refer to a communication channel that allows the utility to obtain meter readings on demand to see if water has been flowing through the meter and onto the buildings. Then

the utility can send instructions to the meter to execute specific tasks, such as instance disconnecting or restricting water flow.

Third, it provides the clients easy reading of the water consumptions at customer site. It helps to check if there are any leaks, reduction of consumption and monitoring compliance with local restrictions.

Lastly, water utilities can have another source of data collection and processing software, such as meter data management application. To be exact, it provides another way of collecting data without affecting the existing billing system from the increasing meter data volumes that smart metering introduces.

In this paper, the smart water metering refers to any water meters that have the presence of any one of the above features.

## **2.2 Trend in Chinese Smart Water Meter Industry**

### **China Policy Implication - 12<sup>th</sup> Five-Year Plan**

In 2011, Chinese government launched the 12<sup>th</sup> Five-Year Plan, which is a detailed economic development guideline for all its regions during the year 2011-2015. In this plan, two of the key themes – “Scientific Development” and “Sustainable Development”- are related to the smart water management. First, in scientific development, scientific innovation is promoted for industrial upgrading. It is encouraged that manufacturers improve their technologies & techniques so as to achieve a sustainable growth in economy. On the other hand, enhancing water resource conservation is one of the sub content under the sustainable development. “We will pay adequate attention to water safety in order to build a water-saving society by setting up water resource allocation systems and **enhancing water resource management** and paid utilization” is stated in the report. This indicates that the Chinese government is

paying attention to the high-tech development in the manufacturing industry as well as the water management issue. (China 12th Five-Year Plan, 2011)

### **Growing Global Demand for Smart Water Meter**

The global demand for smart water meter is growing. According to a recent report from Pike Research, as demand for water rises, water utilities around the globe will be facing pressure to manage water resources as efficiently as possible, and this smart water meter is a key element in smart water management, providing information that helps utilities to control cost and achieve efficient use of resources. Moreover, there are projects demonstrating the growing demand for smart water meter in Europe and North America. For instance, Thames Water, the largest water and sewerage company in the United Kingdom, will extend its smart meter and smart grid trial from the Town of Reading to the City of London. And the City of Sault Ste. Marie in Ontario have been chosen by Federation of Canadian Municipalities to test what effect smart water meters have on residential consumption patterns and attitudes toward conservation. (Rising Demand for Water to be a Key Driver for Smart Water Meter Adoption, 2012)

In China, the demand for smart water meter is rising as well. There are around 110 cities in China which lack of water resources, including the capital Beijing. Individuals including the authorities are starting to pay attention to the smart water management, in which smart water meter plays a significant role in sustainable use in water resource. The government has launched the policy “One meter for one household” to measure the exact water consumption of each household, thus the water utilities can charge individuals on the “user pay” principle. Moreover, the urbanization and urban renewal in China has also pushed the demand for smart water meter. There is a positive relationship with the installation of water meter and the completion of housing in China. In addition, normally a water meter life cycle is around 5 to 8 years; thus old buildings need to replace aging water meters with a new one. The above factors,

lack of water resource and government policy, have encouraged the promotion of smart water meter in China. (Discussion on the Development of Smart Water Meter, 2008)

### **2.3 Regional Competitiveness**

The concept applied in this paper to analyze the industrial clusters' competitiveness in China specific to smart water meter industry is the Porter Diamond Theory. Before introducing the Porter Diamond Theory, it is important to define “competitiveness” & “cluster”. According to Porter (1990), competitiveness refers to productivity in the sense of national level. A nation's goal is to produce a high and rising standard of living for its citizens and this ability depends on the productivity with which a nation's labor and capital are employed. Furthermore, the “regional competitiveness” can be defined as “the ability to produce goods and services which meet the test of international markets, while at the same time maintaining high and sustainable levels of income or, more generally, the ability of regions to generate, while being exposed to external competition, relatively high income and employment levels.” (The Sixth Periodic Report on the Regions, 1999) Hence, it can be summarized that competitiveness refers to the key concept of “productivity”. Also, the concept of regional competitiveness has significant effect on enhancing economic performance such as wage, employment rate, exchange rate, trade volume and GDP per capital as well as gaining sustainable competitive advantage of the regional development. (Porter, 2003 a)

### **2.4 Industry Cluster**

On the other hand, the concept of “cluster” is crucial as well. Cluster is defined by groups of companies and institutions located in a specific geographic region and linked by interdependencies in providing a related group of products or services. (Porter, 2003 b) Due to the proximity among them, it can enjoy economic benefits, such as access to specialized human

resources and knowledge spillovers from the close interaction with specialized customers and suppliers etc. (Christian, 2003)

Porter (2003 b) mentioned that the cluster concept can foster the regional economic development, such as higher wage in that area. So it can be viewed that industry cluster is one of the keys to sustain the regional competitiveness as Porter (2000) stated that “location affects competitive advantage through its influence on productivity and especially on productivity growth.”

## 2.5 Porter Diamond Theory

After introducing the two main key terms, Porter Diamond Theory is a well-known theory on competitiveness. It analyzes national (or regional) competitiveness through four key dimensions - factor conditions, demand conditions, firm strategy structure and rivalry, related and supporting industries; and two auxiliary dimension - government and chance. A region's relative competitiveness relies on the existence and degree of development of, and interaction between, the four dimensions. Weaknesses in any of these dimensions would reduce a region's competitiveness. (Porter, 2000) The dimensions in the Porter Diamond Theory are illustrated as below: (Porter, 1990)

**1) Factor conditions:** This dimension refers to the factors of production which creates the industry's comparative advantage in the international market. The production inputs include:

Human resources: quality and quantity of skilled labor, cost of personnel and labor skill variety;

Physical resources: quantity, quality and accessibility of resources, such as land, water, electricity or other physical traits.

Knowledge resources: market, research and technical knowledge of the nation's research institutions;

Capital resources: availability of capital and cost of financing. They can be affected by the savings rate and structure of national capital market;

Infrastructure: availability and quality of infrastructure, such as: communication system, transportation system, funds, and etc.

**2) Demand conditions:** It refers to both home and international demand condition. The three general attributes of the home demand are: the nature of buyer needs, the size and growth rate of home demand, and the transferability of domestic demand into foreign markets. In order to meet the sophisticated home demand, the industry needs to improve products and offer superior product quality, features and service to create competitiveness.

**3) Related and supporting industries:** It refers to the parts and service suppliers and distributors in the supply chain. The close working relations and the coordination of different parties in the supply chain can enhance the competitiveness of the industries.

**4) Firm strategy, structure and rivalry:** It refers to the context where firms are created, managed and operated given the domestic demand conditions, factor conditions and supporting industry situations. Furthermore, the domestic rivalry or domestic competition gives pressures on firm to innovate and improve productivity and consequently raise the national competitiveness in the industry. Also, Porter added that these local and global competition not only enhance the competitiveness of the industry at home but also push the domestic firms to sell abroad to grow.

**5) Government:** It interacts with the industry by setting up policies, rules and regulations, which is directly responsible for improving the social welfare as well as aiming at economic and political stability. It can influence the 4 dimensions either positively or negatively. First, it can

provide subsidies and impose capital market regulations and educational policies to affect the factor conditions. Besides, it can affect the domestic demand conditions by setting up product standards or regulations that direct customer needs. Competition laws, tax policy and other regulatory policies can affect both supporting industries and firm structure and strategy.

Examples of government policies that improve competitiveness in different ways are as below: a market-controlled economy is more efficient in enhancing productivity and promoting innovation than the planned economy (Blumental, 1999; Agarwal & Wu, 2004) Promotion of joint ventures with global firms will encourage technology transfer as well. (Ali, Na, Law & Buszard, 2004)

**6) Chance:** It refers to external events that may affect a nation or industry which are totally out of the control of firms or government. Examples include wars, economic crisis, major shifts in foreign market demand and etc.; they are crucial in the sense that these events may reshape industry structure and in turn shifts the competitive advantage in many industries.

Below [Figure 1](#) (Porter, 1990) summarizes the six dimensions and their theoretical relationship.

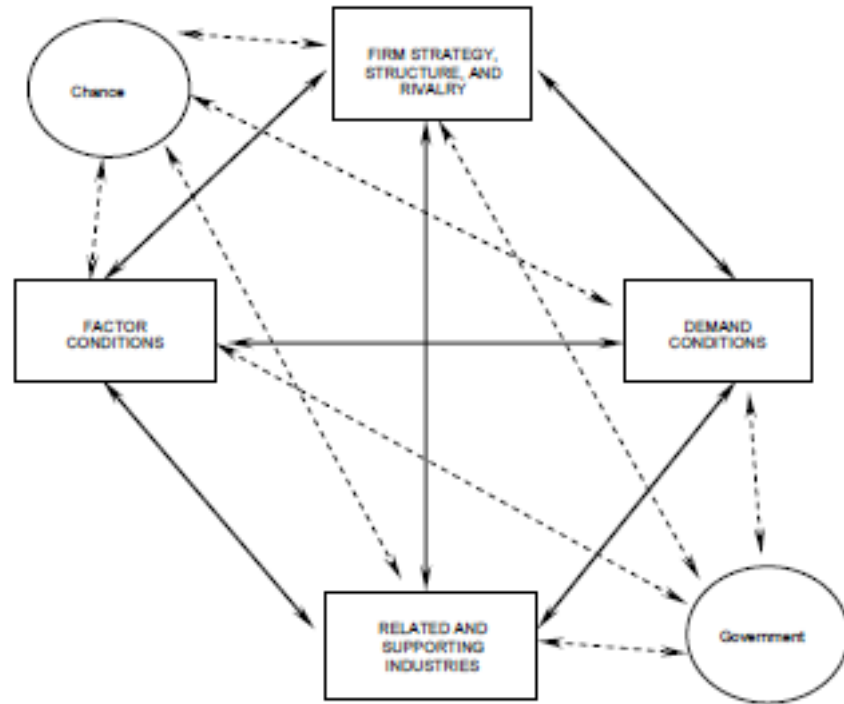


Figure 1: Porter Diamond Theory (Porter, 1990)

## 2.6 Cluster Competitiveness

Porter Diamond Theory only provides a guideline on how to evaluate the cluster competitiveness based on the dimensions. Porter (2003 c) also discussed that firm competitiveness is closely linked to cluster dynamics. The more dynamic the cluster is, the higher the competitiveness of the cluster, vice versa. Below [Table 1](#) illustrates cluster dynamics of the 4 dimensions. This provided a foundation to analyze the three mentioned industry cluster competitiveness among them.

The dynamic cluster environments are characterized as below: (Porter, 2003 c)

### 1) Factor Conditions

Under this aspect, the cluster is more competitive when it has higher access to specialized and advanced factors of production, such as human resources, financial capital, infrastructure, etc.



On the other hand, a static cluster is said to have lack of advanced suppliers or only basic human resources which means it has lower competitiveness compared to the dynamic cluster.

## **2) Demand Conditions**

Dynamic cluster has a higher proximity to sophisticated and demanding buyers, thus in turn creates can pressure firms to innovate and create more advanced products than those of competitors.

## **3) Related and supporting industries**

In this dimension, close linkages and intense cooperation with various institutions for collaboration such as commerce chambers, professional institutions, cluster officials, etc., can promote technological advancements in products as well as attracting talents.

## **4) Firm Strategy, Structure and rivalry**

Firms upgrade product quality and improve productivity due to the intense local rivalry. For instance, they would look for a more advanced and diverse supplier base so as to improve cost-efficiency.

<b>Features</b>	<b>Static Cluster</b>	<b>Dynamic Cluster</b>
<b>1) Factor Condition</b>	Lack of advanced suppliers; basic human resources	Specialized, local suppliers; advanced training and scientific infrastructure
<b>2) Demand Condition</b>	Low in demand condition	Sophisticated buyers
<b>3) Related and Supporting</b>	Few supporting institutions	Advanced institutions for

<b>Industries</b>		collaboration and clusters
<b>4) Firm Strategy, Structure and Rivalry</b>	Isolated firms and lack of competition	Local rivalry and international competition

*Table 1: Cluster Dynamics. (adapted from Porter, 2003 c)*

## 2.7 Applications on Porter Diamond Theory

Many scholars have used the Porter Diamond Theory in analyzing the competitiveness in national level and industry level. Dunning (1993) suggested to consider international factors when analyzing industry or national competitiveness as the increasing interaction between the cross-border value added activities by multinational enterprises have direct or indirect impact on each of the factors of the Porter Diamond Theory. Moreover, Rugman and D'Cruz (1993) extended the Porter Diamond Theory into a double-diamond model, stating that many small economies have at least one weak factor or dimension in the Porter Diamond Theory that they have to rely on the dimension of a foreign diamond. For instance, Canada have a weak demand conditions dimension in its national diamond, it relies on the strong and sophisticated foreign demand from the US diamond.

Apart from applying the Theory on national level, scholars used it to analyze different industries as well. Barragan (2005) adopted the double diamond model to analyze the automobile industry in Mexico. Similar research is also carried out to analyze the same industry in China, which specifically examines the impact of government on industry competitiveness. (Wu, D. 2006)

In this paper, it will adopt the single diamond model without the “Chance” dimension. The “Chance” dimension is neglected as it is unpredictable and could not be measured in this study. Also, it adapts measurements from “Analyzing China’s Automobile Industry Competitiveness

through Porter's Diamond Model" (Wu, D. 2006 et al.) to build a profile of the industry cluster competitiveness. Lastly, the measurements are then agreed with the commissioner and supervisor (please refer to the interview guides in the [Appendix 5](#) & [Appendix 7](#)),

### **3. RESEARCH SETTINGS – CHINA SMART WATER METER INDUSTRY AND PORTER DIAMOND**

The Porter Diamond Theory provides an analytical framework with different dimensions for national or industry competitiveness. Many scholars have been using this Theory in analyzing different nations', regions' and industry competitiveness. Yet, none of them have built profiles of different industry clusters in China regarding the smart water meter industry. Hence, this study can give insights into the industry cluster competitiveness of different clusters in China through the Porter Diamond Theory.

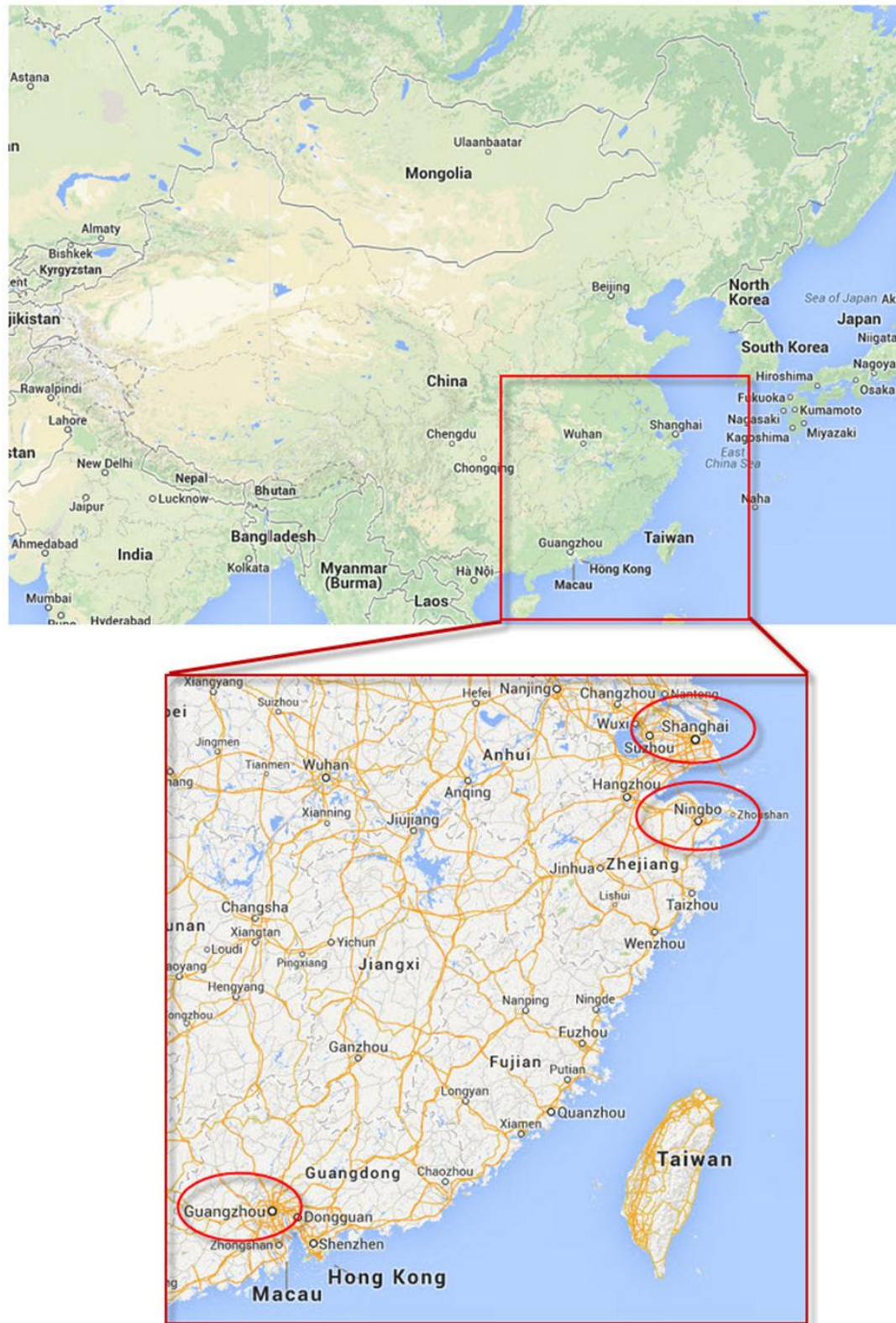
This study focuses on one specific area of smart water management – Metering technologies. By building profiles of different clusters according to the Porter Diamond Theory, it can help to build a general picture to the foreign investors of the Chinese industry cluster. Understanding the core competencies of the researched industry clusters can assist foreign investors on exploring any business opportunities.

This paper is useful for the domestic firms – smart water meter manufacturers – as well. It gives insight into their strengths and the latest details of their industry environment. Hence, they can in turn make use of these details to further enhance their productivity.

### 3.1 Research Question

Before carrying out the research, the target must be identified. Internet research is done to highlight the industrial clusters in China. Since there is no systematic and comprehensive list of Chinese smart water meter suppliers through the online searching engine. One of the most famous B2B global trading website in China, with over 2.8 million of enterprises, Alibaba.com, is used as a source for finding the industrial clusters in China. Alibaba.com is a global e-commerce platform for businesses around the world. It is an English platform for cross-border trades among China and the globe and it serves millions of buyers and suppliers from more than 240 countries and regions, showcases products ranging from raw materials to finished goods in more than 40 industry categories. (Alibaba.com) By using this business platform, It is possible to gather the Chinese water meter suppliers by searching the key word “smart water meter” in the product searching engine. And next step, there is an option suggesting that the industry clusters with the top amount of suppliers, over the 180 suppliers enterprises, are from the few clusters, including: Shanghai, Ningbo and Guangzhou. Hence, the industry clusters are targeted to the following three: Shanghai, Ningbo and Guangzhou. The below [Figure 2](#) indicates the location of the three clusters in China

Combining the smart water meter industry, the research question that this study will address is: What is the industry cluster competitiveness of Guangzhou, Ningbo and Shanghai respectively regarding smart water meter industry?



*Figure 2: Locations of the 3 Chinese Industry Clusters*

#### 4. RESEARCH METHODOLOGY

##### Qualitative Research Method

Mason (1996) stated that research questions must guide the selection and use of research methods. In this study, the qualitative research method is used. The reasons are as below: This research is an exploratory research, which the aim is to study the industry cluster competitiveness and many details are unknown to the author. For instance, how the government dimension affects the cluster competitiveness. Qualitative study is a process of learning what is happening deeply. (Lee, 2008) For instance, by asking open-ended questions, author could also better understand the cluster details. On the other hand, quantitative research is usually used to determine “how often things happen”. Qualitative research could reveal “how something happens and why”. This could provide deeper understanding on the clusters’ details as well.

In addition, author could establish relationships with interviewees through telephone interviews. This relationship establishment could help the commissioner to see if there is any business cooperation among them in the future.

However, there are also some drawbacks of this qualitative research. (Locke, 1998) First, collection of qualitative data takes more time than quantitative data collection, and also there are resource and time limitations in this study. As a result, fewer people are studied meaning there is a smaller sample size compared to quantitative research.

Second, since fewer people are studied, it is usually impossible to generalize results to that of the population. Furthermore, it is difficult to make systematic comparisons. For instance, respondents may give various responses that may be highly subjective.

Third, qualitative research is highly dependent on skills of the researcher.

All in all, although this research has limited time and resources and qualitative research is time-consuming, deeper-understanding is always a top priority on doing this research. By using qualitative method, it aims to produce a wealth of detailed information about a smaller number of people and cases. This may increase understanding of the cluster details and situations.

### **Telephone Interview**

Telephone interviews are done instead of face-to-face interview. This is because the author was in Finland while the interviewees were in China. Performing the telephone interviews is much cheaper than to carry out the latter option.

### **Sources of Data**

Different sources of data are collected in internet research to discover the related details of the three clusters. The internet research is used to identify the interviewees and provide a basic view of the 3 clusters. And the internet data sources are mainly from the government websites, smart water meter companies websites, industry association, news feed in China.

## **4.1 Sampling**

### **Judgmental Purpose Sampling**

For the sampling method in this research, judgmental purpose sampling is used. It is defined as a non-probability sampling technique where the researcher selects units to be sampled based on their knowledge and professional judgment. It is also known as purposive sampling. (Locke, 1998) In this case, both government officials and the smart water meter companies are selected according to the research purpose – to find out the competitiveness of the three industry clusters in China regarding the smart water meter industry, government officials in those 3 clusters which deals with economic and industry affairs are selected, the interview targets of government officials are found through the Chinese government website – Ministry of Industry

and Information Technology of the People's Republic of China – and there is “sub-regional government officials” that mainly deals with those 3 clusters related, which are Shanghai, Guangzhou and Ningbo.; while companies which produce smart water meter within those 3 clusters are selected based on three criteria: 1) own company website; 2) contact (email address and telephone) shown in the website 3) English version of website (preferable but not a must). These criteria could lower the randomization when it comes to sampling process. It could minimize the sampling error, such as bias, in this study.

There are total 13 companies were being selected, Guangzhou with 2 companies, Shanghai with 4 companies and Ningbo with 7 companies. Ningbo has a larger population sample size due to it is a famous water meter industry cluster in China, more details will be explained in the discussion part below. The lists of interviewees are then reviewed and agreed with the commissioner and the supervisor. The contacts of the interviewees are listed in [Appendix 27](#).

### **Sample Size**

*There are no rules for sample size in qualitative inquiry. Sample size depends on what you want to know, the purpose of the inquiry, what's at stake, what will be useful, what will have credibility, and what can be done with available time and resources. (Patton, 1990)*

There is no minimum sample size in this research. This research is valid as long as the sampling procedures and decisions are fully described, explained, and justified so that information users and peer reviews have the appropriate context for judging sample. Moreover, sample size is associated with time and cost and it depends on various types of research designs. (Patton 1990) Lack of time and resources (human) are exactly the restrictions in this research.



## 4.2 Invitation Letter

Once identified the interview targets, the invitation letters have two versions, one is sent to the government officials while another version is sent to water meter companies. This acts as an informed consent in this research, involving clearly explaining the project to potential study participants (see [Appendix 1](#) & [Appendix 3](#)). It is drafted in English and agreed with both commissioner and supervisor after few amendments. Next, it is translated in Chinese by two native speaking research assistant – Yifang Suo & Yi Cai – where Yi Cai will be the “maker” translating the letter; then Yifang Suo will be the “checker” checking the translation and the author will be reviewing again the letter for any misunderstood wordings as the author is a Chinese reader from Hong Kong. This “maker-checker” approach is adopted from one of the central principles of authorization in the information systems of financial organizations. The segregation of duties plays an important role which aims to act a strict control system and check the language appropriateness to avoid any confusion.

The informed consent in this research is in both written and oral form. Invitation letters are sent directly to the contact person email box. For instance, in the government side, the direct contact of the economic; trade; and industry departments were contacted. In the company side, the company managers were contacted. And if there is no direct email box, letter is sent to the general mailbox. After one to two days, follow up calls were made to check if it is possible to make the interviews, which acts as an oral form of informed consent.

### 4.3 Telephone Interviews

Before the telephone interviews, the author did internet research on the basic profiles of the companies selected for preparation. The interview was recorded for further processing and the interviewees are acknowledged as well.

In the telephone interviews, Ms. Yi Cai was the main (first) interviewer for interviewing while Ms Yifang Suo was the backup interviewer in case Ms. Yi Cai is not free to attend the interviews. The reason of why the author is not doing the interview is that Ms. Yifang Suo & Ms. Yi Cai are both native speaker of Chinese while the author has Chinese language courses in his high school for 3 years in Hong Kong and attained an intermediate level of Chinese speaking. Hence, the author were supervising and monitoring the interview calls instead of directly involving in the interviews.

The interview target flow starts from the government officials in the three cluster. Then the Guangzhou companies, Shanghai companies and Ningbo companies are attempted later on one by one. This step-by-step interviewing strategy would give experiences to the interviewer to modify and enhance the interviewing skills.

Lastly, the interview data collected – voice recording – are then transcribed by the two research assistants by the “maker-checker” approach. Then the transcriptions are then reviewed by the author for double-checking.

#### 4.4 Semi-Structured Interview

Since this research is an exploratory research – exploring the competitiveness of the industry clusters, the semi-structured method is adopted, providing the author and the interviewees a framework of themes to be explored. It is guided by a more detailed topic guide which will contain some fairly specific questions to ask, and likely ways of probing, examples to ask for and so on. There remains a lot of flexibility to follow up individual points, but in general the same questions will be asked of each interviewee. (Lee, 2008) In the semi-structured interviews, the questions types (see [Appendix 5](#) & [Appendix 7](#)) are discussed with the commissioner and supervisor beforehand and agreed after adjustments. They are mainly focusing on exploring the R&D aspect regarding the industry cluster in both government and company version. Also, the questions are translated in Chinese by the two research assistant with the same “maker-checker” approach.

The “discussion with commissioner and supervisor” and “maker-checker” approaches serve as a similar approach as the pre-testing in a research process. It provides an opportunity in advance to check data collection form to minimize errors due to improper design elements, such as question-wording or sequence. Additional benefits include discovery of confusing interviewing instructions, language appropriateness, duplicated questions or double meaning with two questions. (Adams, 2007)

#### 4.5 Credibility, Validity & Reliability

When it comes to the creditability of this research, the translation of materials is the major concern. Throughout the whole research process, almost most of the materials are available only in Chinese, including the interview data; only few companies and government materials collected are available in English only. Hence, there are measures adopted to tackle this translation issue. First, the author’s supervisor invited 2 Chinese students who are studying

International Business as the assistants in this research for translating and conducting interviews. They are both native speaking and are studying International Business in Finland. In addition, the author is also a Chinese literacy from Hong Kong. He has been studying in Hong Kong, where Chinese and English are the official languages, for 11 years. Hence, the author could review all the translating data from the assistants, ensuring there are no confusions when translating. Second, the “maker-checker approach” is used to ensure no misunderstanding during the translation process. For instance, when transcribing the interview data, the segregation of duty can be used as a control system. Third, a credible translating source is very crucial as well. The Oxford Advanced Learner’s Dictionary is used as a main reference when translating.

In addition to the translation issue, the background of the researcher is crucial when reviewing the validity of a research. Lofland (1971) states that qualitative researcher is to be able to provide an orderly description with rich descriptive detail. Peshkin (1988) added that the key point when reviewing a research is to be aware of how one’s carefully document all procedures so that others can review methods for bias, and to be open in describing the limitations of the perspective presented. The author has been studying International Business for a year in Finland and Germany respectively. With a year of practical training in an international bank, the author has equipped himself with the research skills and practical business world skill required to carry out the research.

Reliability involves the accuracy of the research methods and techniques. It often relies upon standardization of research instruments or tools. (Mason, 1996) In this research, a standardized version of interview guides are used to interview the government officials and companies, that means same questions are asked in all the interviews. Also, different sources of data, ranging from government official websites to companies websites, are collected in the internet research.

This means that various sources of data collection & standardized research method are used to study the details of the cluster competitiveness.

## **5. RESEARCH RESULTS**

### **5.1 Telephone Interviews - Government**

In the government officials' interviews, calls were made to all the invited interviewees and the results were not favorable. In the three clusters, direct telephone contact to the specific department – economic; trade; and industry development departments were made instead of general hotline to increase the chance of getting an interview. However, the government officials in the three clusters did not have much time to respond to the research enquiry or invitation for interviewing, so not much data are gathered from them.

Due to limited information gathered from the government officials' interviews and limited research time, the author could only carry out internet research only. However, due to huge amount of information in the government websites; most of them are in Chinese; and smart water meter is a small industry in China at the moment, limited information about the smart water meter industry could be extracted and translated to English. Moreover, the information may not directly related to the smart water meter but applies in a general way, such as the research and development policies of the government are related to the technology development part of the smart water meter.

### **5.2 Telephone Interview – Smart Water Meter Companies**

In contrast to the interview result of the government officials, the outcomes from the smart water meter companies are relatively better. The response rate, 69%, was average on whole, 9 interview calls were made out of 13 interview call attempts. 2 contacts are dead number while the other 2 calls were being rejected. In Shanghai, 2 calls out of 4 attempts were successful

interviewed. In Guangzhou, 2 calls out of 2 attempts were successful interviewed. In Ningbo, 5 calls out of 7 attempts were successful interviewed.

In the interviews, some questions were not fully answered or left blank. Reasons are as below:

First, some questions were not asked as the secondary research – company website-beforehand is already done. Second, some questions were left blank after both primary and secondary research. For instance, one question in the interview that few interviewees are found uncomfortable with it, that is, “What kind of average qualification does your line staff (staff level) & factory manager (management level) in your company have in respectively?” they have responded with “company secret”. Hence, the information may not be that detailed for analysis. Third, few companies responded several questions and have shown no interest in continuing the interview, thus the company profiles may not be comprehensive enough.

The company profiles are listed in the [Appendix 9-21](#) and it is a summary of both primary and secondary data research.

### **5.3 Scoping Down**

After collecting the data from both primary and secondary research, it was found out that the details collected in Guangzhou and Shanghai industry cluster were not sufficient enough to further research on their industry cluster competitiveness with the Porter Diamond Theory. For instance, the information of the government and companies collected in Guangzhou industry cluster, such as R&D details, are not enough to proceed on further analysis. On the contrary, the information collected about the Ningbo industry cluster is a lot more relatively, for instance, the population sample and the respond rate in Ningbo is bigger compared to the other two. Hence, after discussion with supervisor and acknowledgement with the

commissioner, the research question is scoped down to analyze Ningbo industry cluster competitiveness with the Porter Diamond Theory.

Furthermore, the details collected of the Shanghai and Guangzhou industry cluster still have research value in the future, though they are not comprehensive enough. They are still included in the appendix for future research. (See List of Appendix for more information)

#### **5.4 Basic Descriptions of Ningbo Companies**

Below are the basic descriptions about the interviewed companies in Ningbo. Among them, Company A and Company B outstands the other in terms of company scale and production units. In addition, Company D and Company B sell their own water meter brand respectively.

Company A: A private limited company, transformed from a state-owned enterprise, has more than 1200 staff and around 350 staff belongs to the research department. Its annual production of water meter is 20 million units and sales revenue is over 1 billion RMB (~122 million Euro). It has an extensive sales network – 2600 sales points - within China and 7 sales branches in the world.

Company B: A private limited company, the biggest water meter manufacturing in China, is transformed from a state-owned enterprise. The annual production of water meter is 600 million units and they sell their own brand “NB” water meter. Their customers are from the globe, including Russia and Europe.

Company C: A private limited company which mainly deals with domestic water supplies companies, industrial and mining enterprises and real estate companies. They sell “NB” brand water meter from Company B. and provide after-sale services.

Company D: A private company which sells mainly to domestic market, such as Beijing, Jiangsu and Hebei. They have their own brand “Longkang” water meter. Annual production for IC card meter is around 800 thousand units. They sell “Longkang” brand water meter; IC card water meter; remote meter and water meter components for other smart water meter companies

Company E: A private limited company which sells water meter components to water meter companies in China. Examples of customers include: Company A, Company B, Jiangxi Gan River Water Meter Co., Ltd., and Wasion Group.

Company F: A private limited company which sells mechanical water meter series, IC card water meter series, wireless remote meter series, wireless valve water meter series, etc. to domestic, African and middle-east markets. Their main customer types include offices, communities, buildings, and housing estates.

Company G: A private limited company which sells “NB” brand water meter from Company A and provide sales services for those water meters. Their product types include industrial use water meter – remote meter, flow transmitters and meter reading system, and non-industrial use water meter - IC card water meter, pulse sender water meter and heat meter.

## **6. DISCUSSION – NINGBO INDUSTRY CLUSTER**

As discussed in previous part, it will adapt measurements that are agreed with the commissioner and supervisor before (Please refer to the interview guides in the [Appendix 5](#) & [Appendix 7](#)). Due to research limitation (data researched & research time), it will focus on



discussing parts that the data are available after the research process. The list of measurements about the Porter Diamond Theory is summarized in below [Table 2](#).

<b><u>Dimensions</u></b>	<b><u>Measurements</u></b>
<b>Factor Conditions</b>	Logistics Infrastructure
	Labor Training & Labor Quality
	Research & Development Team; Technology Level; Patent & Trademark
	Capital Source – Private Limited Company
<b>Demand Conditions</b>	Growing Domestic & Global Demand
<b>Related and Supporting Industries</b>	Supporting Associations & Institutions in Ningbo
	Certifications on Management or Product
	Original Equipment Manufacturer (OEM)
	Supplier Source
<b>Firm Strategy, Structure and Rivalry</b>	Major types of smart meter models
	Development of water meter companies
<b>Government</b>	Key Industry – Meter Equipment Manufacturing

*Table 2: Measurements of the Porter Diamond Theory (adapted from Wu, D. 2006 et al.)*

### **Overview of Ningbo – City of Water Meter**

Ningbo is a seaport city, that lies south of the Hangzhou Bay and facing the East China Sea to the east, in the northeast of Zhejiang province, China. It holds sub-provincial administrative status and separate state-planning status since 2010 census. Below [Figure 3](#) shows the map of Ningbo with the basic infrastructures.

In 2009, China Machinery Industry Federation, an integrated national industry association comprised of various Chinese industry associations and are recognized by the Chinese government, awarded Ningbo as the “City of Water Meter”. This award is valid for 5 years. It implies that Ningbo has high cluster competitiveness in water meter industry in terms of social

infrastructure; research and development; industry development, and etc. Recent data has also shown that Ningbo's water meter production accounted for over 50% in China, water meter components supplies accounted over 75%, and the export volume for water meter makes up to 78.8% of the whole China. (China Water Meter City - Ningbo, 2009)



Figure 3: Ningbo Map

## 6.1 Factor Conditions

When it comes to the factor conditions of the Ningbo industry, it mainly refers to the factors of production that creates the Ningbo's industry comparative advantage in the international market. Aspects will be discuss are infrastructure; human resources; knowledge resources; and financial resources

### 6.1.1 Infrastructure

#### **Well-developed Logistics Infrastructure**

The infrastructures in Ningbo are well established to support the water meter development. Ningbo is the economic center of south wing of Yangtze River Delta, the sea, air and land transportation is well-connected to global and other Chinese cities. For sea transport, Ningbo Port, located on the coastal province of Zhejiang, is one of the most essential and busiest ports in China. It comprises several ports which are Beilun (seaport), Zhenhai (estuary port) and old Ningbo harbor (inland river port), Daxie and Chuanshan. Moreover, Ningbo Lishe International Airport is one of the four international airports in the River Delta. It has two railways and five expressways connecting the whole China. For instance, there are high speed railways connecting to main cities as Hangzhou, Shanghai and Nanjing. Ningbo. One of the three cross-sea bridges – Hangzhou Bay Bridge – can shorten the travelling time between Shanghai and Ningbo within 2.5 driving hours. (About Ningbo)

This well-connected logistic system helps the water meter companies in Ningbo to export through different channels according to their markets selling. For instance, two of the interviewees' – Company E – customers are those water meter companies in China, which are located in different parts of China. That company could make use of the well-developed logistic to transport the water meter components to its customers. In addition, Company B is selling their meters to the globe. It can make use of the different transportation means to export products to various markets.

The logistics management quality is guaranteed in Ningbo as well. For instance, in Ningbo port, many international logistics enterprises such as MSK, GLP, DHL IBM, Sino Tran and CSC have been developed in Ningbo already. And even if there is a high demand in water meter that

may in turn increase the logistic pressure from Ningbo to other Chinese cities or overseas, it can still be able to withstand the pressure as the logistic system in Ningbo is continuing expanding. For instance, the Ningbo port has been merged with the neighboring Port of Zhoushan to form a combined cargo-handling center in order to increase the logistic capacity. Data has also shown that the cargo throughput is 450 million tons in 2012 with a 4.5% growth compared to 2011, where the foreign trade cargo throughput category counts for 250 million tons, with a 6.5% growth compared to 2011.

### 6.1.2 Human Resources

This dimension is about the labor training and the labor quality of the water meter companies in Ningbo. Although there is not much information generated from the primary research as some refused to answer due to company secret, there are still some useful information generated from few companies websites.

#### **Labor Training**

Since manufacturing water meter or smart water meter requires a high standard of labor quality to innovate and produce, and the product quality directly affects the customers' satisfaction, such as water supply utilities' production cost may increase due to incorrect measurement of water volume, the labor training in this industry is therefore essential. Few companies, such as Company F and Company A, provide regular training to their staff. The latter company values "human resources" as their company's most valuable assets, which they have a systematic training system designed by their human resource department. It has audit test every year for staff evaluation, including the technology staff, areas are audited such as work performance to determine whether they are qualified to continue for working. Furthermore,

compulsory trainings for new joiners of companies common in the water meter companies, especially the trainings for those quality control staff and technology staff.

### **Labor Quality**

The quality of water meter companies' staff varies depending on the job nature. In Company B, the production management staff qualification is normally bachelor or above. The percentage of average qualification for technique staff is bachelor degree or above is around 30%. For manufacturing staff, not all of them require bachelor degree, but having working experience is a must. On the other hand, the research technology staff, such as technology supervisor or laboratory vice manager, are normally master or above level. The company also encourages their technical staff to attend trainings held by Ningbo Water Meter Industry Association to enhance their skills and knowledge. The trainings mainly cover 3 areas – quality-improving, quality-maintaining and production efficiency.

#### **6.1.3 Knowledge Resources**

This dimension is about the industry's sustainable development of research and development. Companies' research and development team, production technology level and protection on trademark and patent will be discussed.

### **Research & Development Team**

Most of the companies interviewed have their own research and development team on water meters. Some of them have cooperation with local universities and other water meter companies as well. For instance, Company B has cooperation with Chinese Academy of Sciences (CAS), Zhejiang University, Ningbo University, Ningbo Institute of Materials Technology and Engineering (NIMTE), and other universities and research institutions to

develop water meter. Besides, the water meter companies may jointly cooperate together to develop products, such as the Company C and the Company B.

The Company B has a systematic research and development team. It has a water meter engineering center (provincial level), equipped with various types of advanced scientific research facilities, and specializes in innovative water measurement technologies, developing, and manufacturing. In addition to its engineering center, it also makes use of its subsidiary to develop other types of water meter, such as the remote water meter and the card water meter. For more information on its systematic research and development team, please see below [Figure 4](#) and [Appendix 15](#).

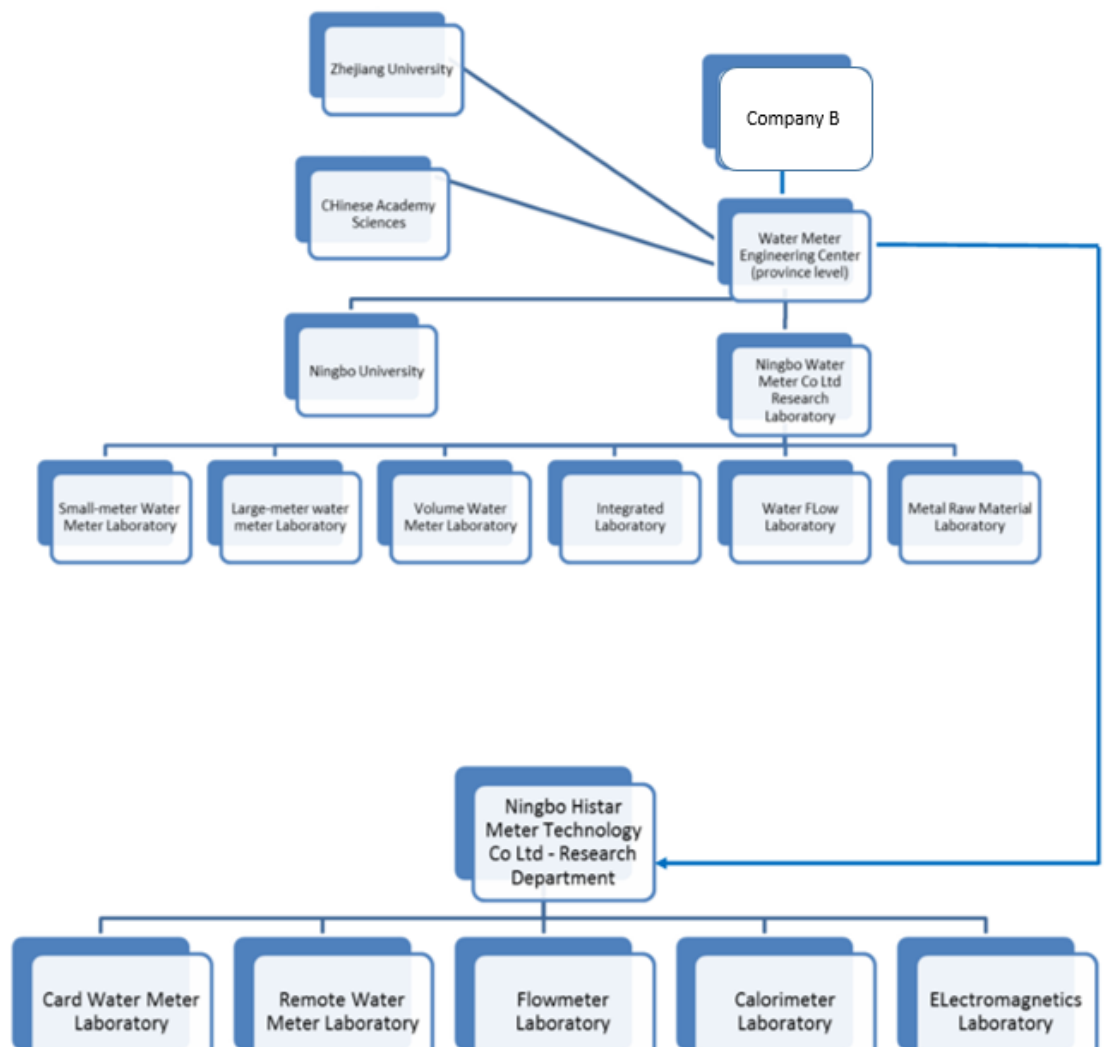


Figure 4: Company B Research Team (Company B Website)

On the contrary, some develop their water meter on their own research team. The Company D has developed over 17 water meter types and 108 products. The reason is that it may take advantage of its OEM experience for other water meter companies so that they have the ability to develop their own brand – “Longkang” brand water meter. (More information on OEM will be discussed in “Related and supporting industries” dimension)

### **Technology Level**

The technology levels among the water meter companies depend on their company resources. Some produce water meter by machines mainly, while some produce partly automation and partly labor for assembling. Few companies, Company D, Company A and Company B have developed their own quality control system to ensure output quality. For instance, Company A has 58 sets of advanced testing equipment or checking on assembly line. Company D and Company B have quality control testing in every production stage, and the former company developed their own performance index card on checking output quality.

### **Registration of Own Patent & Trademark**

Most companies have registered their own trademark and patent in China, according to the interview results. For trademark registration examples, Company B and Company D have registered the brand – “NB” water meter and “Longkang” water meter – in China respectively. Also, Company A has been awarded the Zhejuang Famous Trademark Certificate.

Registering patent “protects” company assets and allows the company to “attack” others. If a company registered patent for its product, other companies could not replicate the same product or technology that you have manufactured as you have registered patent, forming a “protection shell” for your company assets. On the other hand, it gives you the ability to “attack” others by taking legal actions if they have replicate the product or technology that you

have produced as you have registered the patent. Most interviewed companies stated that they have registered patents for their smart water meter in China. For instance, Company D registered patent for more than 20 types of IC card water meter design patent. Company B applies 20 patents for its products per year, such as automatic meter reading system and high-precision water flow detection device. Foreign investors should take note that whether the patent is still valid or not as the patents usually have a validity period and especially which type of patent has the company registered for the water meter. Some companies may claim that they have registered the patent for the product. Yet the patent is referring to the design patent only instead of the patent on the technology.

#### 6.1.4 Financial Resources

##### **Limited Capital Source**

Financial resources are one of the main factors of productions when we talk about the water meter industry. The reason behind that is it requires the entrepreneur to invest a lot on production machines; manufacturing or technology staff; factory land and etc., in advance. According to the summary of the interviewees in Ningbo, all of them are private limited company. It means that the capital sources of those companies are mainly from the shareholders, suggesting that their capital source is limited when comparing with the public limited company, which can raise capital source by issuing share, for instance. Due to the limitation on capital source, it may restrict water meter companies in developing new technologies on smart water meter. And as this research and development on smart water meter usually requires a longer break-even time, which is having positive profits after covering the investment cost on research and development, most companies may then prefer to be an original equipment manufacturer or to cooperate with other research institutions to develop smart water meter instead of developing their own brand of smart water meter. Plus, the



research and development is the most important part when developing smart water meters. As a result, this limitation on capital which may restrict on Ningbo's companies' research and development harms those companies productivity as well as their competitiveness.

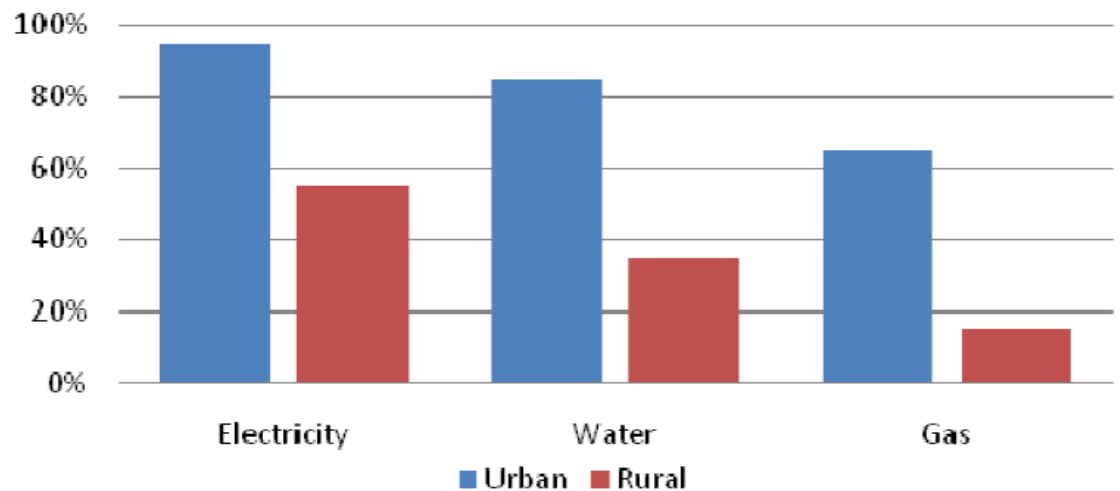
## **6.2 Demand Conditions**

This dimension refers to the domestic and international demand for smart water meter. From the perspective of foreign investor, it may be a reference to them as it is just descriptive data for them when considering production or outsourcing.

### **6.2.1 Growing Domestic Demand**

The domestic demand for smart water meter is growing steadily. According to China Smart Meter Industry Report 2013-2016 (2013), the market scale of Chinese smart water meters will reach 16.5 million units separately in 2016, with the compound annual growth rate of 19.21% in the period 2013 to 2016. The main reason is the policy launched - "One meter per household" - to measure the exact water consumption of each household, thus the water supply utilities can charge individuals on the "user pay" principle. This policy encourages the public to purchase new water meter in order to fulfill the policy requirement. [Figure 5](#) shows the progress of the policy implementation in China in 2009. In addition, there regional utility companies are trying to maximize profits through adopting the use of smart water meter. The use of smart water meter can result in significant cost reduction. In China, water loss rates can reach as high as 50%. Using meters that are more accurate and reading those meters more frequently can quickly help identify loss in the water system. (China Smart Meter Industry Primer Multi-Year Report, 2010)

## 2009 PROGRESS OF 'ONE METER PER HOUSEHOLD' POLICY IN CHINA



*Figure 5: Progress of 'one meter per household' Policy in China in 2009 (China Smart Meter Industry Primer Multi-Year Report, 2010)*

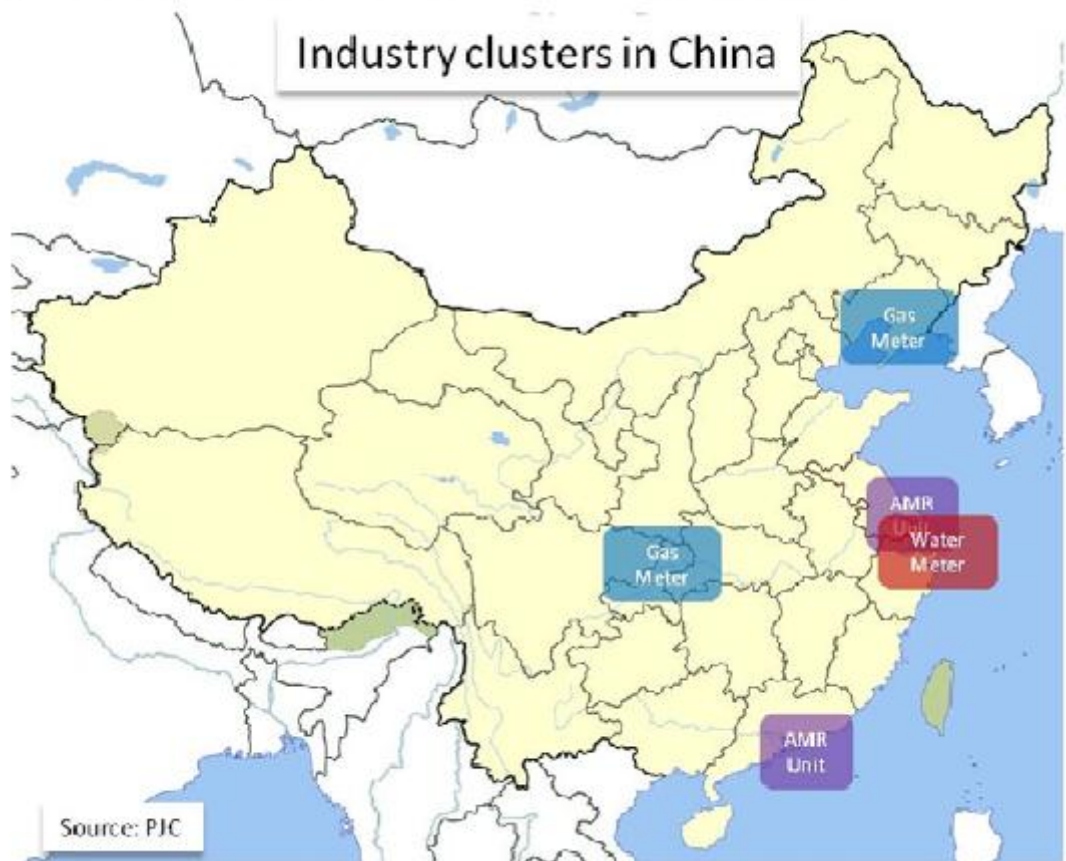
### 6.2.2 Rising Global Demand

The global demand for smart water meter is increasing as well. Since the demand for water rises, water utilities around the world will be facing pressure to manage water resources as efficiently as possible, and this smart water meter is a key element in smart water management, providing information that helps utilities to control cost and achieve efficient use of resources. Hence, they would tend to replace the smart water meter from the old water meter for better the promotion of smart water management.

Ningbo is one of the major clusters to product and export water meter in China. The export of water meter to the European Union and Russia has been increasing. The export of water meter in 2012 is 6 687 thousand units, increased 19.8% compared to 2011. Company A has also been exporting products to Russia and Czech Republic, mentioned from the interview. In addition, Ningbo's water meter production accounted for over 50% in China, water meter components supplies accounted over 75%, and the export volume for water meter makes up to 78.8% of

the whole China. ("China Water Meter City" Ningbo Water Meter export over 8 thousand units, 2013) The China Smart Meter Industry Primer Multi-Year Report also concluded that Ningbo is one of the major industry clusters of water meter, as shown in [Figure 6](#)

#### WATER & GAS METER INDUSTRY CLUSTERS IN CHINA



*Figure 6: Water & Gas Meter Industry Clusters in China (China Smart Meter Industry Primer Multi-Year Report)*

### 6.3 Related & Supporting Industries

#### 6.3.1 Supporting Associations / Institutions in Ningbo

Since Ningbo is a famous industry cluster for producing water meter, there are a variety of institutions, ranging from universities, industry associations to government institutions, are located in Ningbo to support and develop the industry.

First of all, there are universities and research institutions that support the water meter industry in Ningbo. For instance, the Company B has cooperation with Chinese Academy of Sciences, Zhejiang University, Ningbo University, Ningbo Institute of Materials Technology and Engineering, and other universities and research institutions to develop advanced technology. Also, the Company A has cooperation with Zhejiang Worker's University of Economic Management, a university specialized for adult education that have courses offered to its staff to study business management.

In addition to the universities, there are some associations that provide support to the industry as well. The Ningbo Institute of Metrology, a voluntary non-profit association comprised of measurement engineers; water meter manufacturers and professors, is one of the examples. It aims to promote science and technology measurement test, application of advanced metering technology and management practices. (Ningbo Institute of Metrology) Another industry association – Ningbo Water Meter Industry Association – also aims to promote Ningbo water meter industry and coordinate among the water meter companies in Ningbo to improve the cluster competitiveness. The members are mostly from the water meter companies in Ningbo. Both associations have organized trainings for those quality control staff and technical staff from the water meter companies for them to enhance their skills and knowledge. (Ningbo Water Meter Industry Association)

There are also government institutions that support the water meter companies in Ningbo. National Water Meter Product Quality Supervision and Inspection Center (Ningbo) is under organization – Ningbo Bureau of Quality and Technical Supervision. It is responsible for testing the quality of various types of water meter in terms of measurements, production method and production standard. Besides, the Measurement and Testing Institute (Ningbo) is a legal metrology agency responsible for enforcing the measurement standardization of meter

equipment in Ningbo. (National Water Meter Product Quality Supervision and Inspection Center (Ningbo))

### 6.3.2 Certifications

#### **Basic Certifications Acquired - ISO**

From the interviewed companies, almost all of them (6 out of 7 companies) have gained basic international certification – ISO – to prove that they have high quality management. The most common certification is ISO 9000 family, which means that the companies ensure their products and services are consistently meeting customer's requirements and that quality is consistently improved.

For companies that only sell in domestic market, they usually possess the ISO 9001 certification only. This implies the domestic customers do not demand high qualifications from the water meter companies. On the other hand, for companies that export to the global, such as Company A and Company B, they have more than only just the international ISO certifications to prove their high quality of products and services. Instead, they even possess foreign countries certifications, such as the Korean Standard (KS); Australian Standard (AS); UL Standards (for U.S.A.) and etc. These foreign countries certifications would enhance overseas customers' confidence on their product quality and would therefore be willing to choose to cooperate with them. Furthermore, some companies have the Voluntary National Standards, applied in China, for further proving their product quality. For instance, the "LongKang" brand, produced by Company D, IC card water meter has the Voluntary National Standards, CJ/T133-2001; GB/T778 and GB/T778.1B.

Apart from that, some companies offering Original Equipment Manufacturer (OEM) service may not need to acquire the foreign certifications in order to export their products overseas. The reason behind is that the water meter brand name is the purchaser of the OEM service, meaning that the purchaser needs to acquire by themselves instead of the OEM provider. For more information on the certifications details, and certifications organizations of both foreign and domestic, please find the [Appendix 24](#)

### 6.3.3 Original Equipment Manufacturer (OEM)

#### **Developing from OEM to own brand water meter**

The interviewed companies sell their own brand water meter as well as providing Original Equipment Manufacturer (OEM) service, meaning company manufactures products or components that are purchased by another company and retailed under that purchasing company's brand name. The companies are Company D; Company A and Company B. They all have their own brand name of water meter, for instance, “Longkang” from Company D and “NB brand” from Company B. And Company B provides Original Design Manufacturer (ODM) service as well. This type of manufacturer suggests that the companies may have developed their own brand name of water meter from the OEM experience. This can be supported from the development of the Company D. It is mentioned that the company started to produce water meter components for those water meter companies and provide OEM service in 1997. In 2002, the company began to produce their own brand of water meter “Longkang” brand water meter. Hence, foreign investors shall pay attention to the cooperation agreements between their business partners on the technology transferring. Registering patents beforehand are possible ways to avoid any business risks. Please contact your business advisors for more information on how to protect your know-how technology.

### 6.3.4 Supplier Source

#### **Domestic Source of Suppliers**

Most of the water meter companies in Ningbo buy their water meter components from domestic instead of overseas. For example, the Ningbo Hongshun Machinery and Electric Equipment Instrument Factory supplies water meter components to Company B and other water meter companies. Sourcing water meter components in domestic instead of overseas could lower the production cost of water meters. It also gives flexibility on production if there is a high demand on water meter suddenly. Take an example of Company B, if there is a high demand for water meter suddenly, it can acquire the component parts from the suppliers instantly, given there is enough component available, and transportation time for those components are very short when compared to sourcing from overseas or other regions in China. As a result, this domestic sourcing of supplier would give a competitive edge of Ningbo industry cluster on productivity.

#### **Supply Chain of Company B**

Through the research in Ningbo's water meter companies, it is discovered the supply chain of Company B is located in Ningbo itself. For instance, the company purchase the water meter components from another company located in Ningbo that is, the Company E. And it has its own factory which is located in Ningbo as well. The 45000 m<sup>2</sup>-size factory was built in 2006, manufacturing water meter equipped with advanced technology departments and automation machines. In addition, it has subsidiaries in Ningbo as well for research and development of various types of water meter. The research institutions and universities that it is cooperating with are located within or near Ningbo as well, such as the Ningbo University and Zhejiang University. And for the sales part, the companies are located within Ningbo as well, such as Company C & Company G. They both sell "NB" water meter to domestic customers but

different types. For instance, Company C sells to domestic water supplies company, industrial and mining enterprises and real estate companies. With nearly the whole supply chain lies within Ningbo would achieve the economics of scale and enhance their competitiveness.

## **6.4 Firm Strategy & Structure**

### **6.4.1 Privatization from State-owned Enterprise**

In the firm strategy & structure dimension, the developments of the water meter companies are one of the essential factors to the cluster competitiveness. There are two companies – Company B and Company A – were state-owned enterprise before. According to their companies' websites, Company B reformed from a state-owned factory to a private company, establishing Company B in 2000, while Company A also reformed in 2005. This privatization from state-owned enterprise gives insights on the cluster competitiveness and also explains why the two companies outstand the others water meter companies in terms of production units; sales volume; customer types, and etc.

When the two companies were still operated by the Chinese government, they had already high market share in water meter due to the state-owned enterprises privileges. The government could provide favorable policies to facilitate the development of the water meter industry. For instance, allocating rent-free land for them to build factories; providing subsidies for productions; and especially extending company's network within the government. Consequently, these state-owned enterprise privileges could let the companies to develop faster compared to a private enterprise without those favorable policies. As the networking in China is extremely important when doing business, it gives the business to operate smoother. For instance, the administrative process within the government could be shorter than the normal processing.



After the privatization, the two companies have already established their comparative advantages over the others in terms of physical resources and capital resources. The company strategies of those two companies would then be changed to profit-driven. For instance, Company B has defined the water meter as their key products and adopted the differentiation strategy, establishing their own “NB” brand water meter in domestic and overseas market. On the other hand, Company A aims to provide customer satisfaction and values their human resource very much within the company.

With the established privileges especially the networking in China, they would then have the resources to research and develop smart water meters. For instance, Company B spent 1613 million RMB (~195 million euro), accounted 3.2% of the sales revenue in 2008. On the other hand, Company A spent 500 thousand RMB (60 thousand euro) per year on regular labor training. Hence, this historical state-owned enterprise factor may be one of the factors to enhance those companies productivity.

#### **6.4.2 Product Types – IC Card Water Meter & Remote Water Meter**

According to the research data, most of the companies offer the IC card smart water meter and the remote water meter. Company F; Company G; Company D; and Company B have provided the mentioned water meters. Yet, they are selling to different customer types. For instance, Company F is selling the IC card water meter, mainly to offices, communities, buildings and housing estate while Company C sells IC card water meter to domestic water supplies Company, industrial and mining enterprises; and real estate companies.

Also, the popularity of these two water meter may be due to the government policy or memo issued in the 12<sup>th</sup> Five-Year Plan – Ningbo. It seems that possibly by producing these types of water meter, companies could enjoy some favorable policies from the government. Nevertheless, this is yet to be confirmed from the government officials.

## 6.5 Government

### **Key Industry: Meter Equipment Manufacturing**

On the country level, China has set some general developing directions for the city governments to follow through the 12<sup>th</sup> Five-Year Plan, as explained earlier. Two of the key themes - “Scientific Development” and “Sustainable Development” – that are related to the smart water meter industry development.

On the Ningbo city government level, meter equipment manufacturing is one of the key encouraging industries. The Ningbo government has recognized the importance of going “digital” for this industry. And due to the Chinese government has outlined the “Scientific Development” and “Sustainable Development” as the general developing indicators, the Ningbo government will launch favorable policies to encourage the industry development. Examples are providing tax rebate to companies and low-interest capital.

Specifically, the Ningbo government has identified certain water meter products as their key developing products within the water meter industry. The key developing products are: non-contactable IC card smart water meter and remote water meter. (Ningbo Manufacturing Planning 12th 5 Year Plan)

As a result, this government dimension interacts with the other dimensions through launching policies to support this key industry, such as tax rebate, to enhance companies' competitiveness as well as the cluster competitiveness.

## **7. LIMITATIONS & FUTURE RESEARCH**

In this research, there are few limitations that must be addressed.

First of all, the research data collected are mainly secondary data and are specific to few companies in the three industry clusters. For the government related data are mostly collected through the official government websites, while the company data are mainly derived from their company websites and the some other information are collected through the primary data research – telephone interview. Thus it provides limited analysis of the industry cluster. If one wants to further understand the industry, future study can incorporate more primary data from government and water meter companies, and draw conclusions on the interrelationship between the theoretical indicators.

Second, this single case study – smart water meter industry - cannot be generalized to other industries or to other countries. This study was originally aimed to analyze the three industry clusters – Guangzhou, Shanghai, and Ningbo. Due to certain research limitations mentioned before, it only focuses on the Ningbo industry cluster. Yet, some information about the other two industry clusters is included in the appendix for further reference. Also, comparing the other broad survey of industries and more characteristic of studies of national competitiveness, this study has provided a deeper insight into the dynamics of competitiveness of a single industry cluster in China.

Lastly, this research has limited time to finish. It has only less than two months to complete all the parts, including the interviews, research, translation and etc. In the future, this study could provide

an insight for foreign investors, companies, and related government and institutions on their own cluster competitiveness. It also provides a foundation for future research on whether to outsource on production on water meter, for instance.

## **8. CONCLUSION**

This study originally was aimed to analyze the three industry cluster competitiveness – Guangzhou, Shanghai, and Ningbo - and build an industry cluster profile for each of them. Yet, due to certain research limitations, this study has to be scoped down to analyze one industry cluster – Ningbo – instead.

After analyzing the smart water meter industry in Ningbo industry cluster with the use of Porter Diamond Theory, we can see the interactions among the dimensions with real examples. For example, the interaction among the “related & supporting industries”, “government” and “firm strategy and structure” dimensions. In the government dimension, meter equipment manufacturing is one of the key industries that the Ningbo government wants to encourage, and the product types – remote water meter and IC card water meter are those key products to be promoted. In the “related & supporting industries”, there are many institutions to support the industry development. Also, in the “firm strategy & structure”, most water meter companies in Ningbo offer those 2 product types exactly.

Another example is the interaction between the “factor conditions” and the “demand conditions”. In the “factor conditions”, the well-established logistic infrastructure can support the growing demand for smart water meter in the “demand conditions” dimension. Those companies could make use of different means of logistics to export their products globally or domestically

The “related & supporting industries” also interacts with the “demand conditions”. Some smart water meter companies may acquire foreign certifications so as to increase the confidence of foreign customers. For instance, the Korean standard and Australian standard. This strategy of acquiring foreign standards may be due to increasing demand for smart water meter, and those companies want to enhance their competitiveness by acquiring those certifications.

There are interactions between “firm strategy & structure” and “factor conditions” too. The privatization of state-owned enterprises has already established competitive edges among the water meter companies. They have more resources to research and develop smart water meter. And therefore developing their own brand of water meter. On the other hand, the OEM experience may give some companies the chance to develop their own research and development team as well as their own water meter brand. Yet, some companies may choose to cooperate with local universities and other water meter companies to develop water meters

Lastly, the above interactions are just some examples of showing the dynamics of this Ningbo industry cluster. As mentioned before, the more dynamic the cluster is, the higher the competitiveness of the cluster. In “factor conditions” dimension, this cluster is competitive in terms of human resources, knowledge resources and infrastructure compared to a static cluster which may have only basic human resources. In “demand conditions” dimension, the domestic and global demand for smart water meter are growing and therefore may drive companies to innovate and create more advanced smart water meters than their competitors. In “related and supporting industries”, this cluster has close linkages and intense cooperation with various institutions for collaboration, such as the universities, companies and suppliers. And in “firm strategy, structure and rivalry” dimension, companies offer different types of smart water meters to various types of customers. Also, the privatization from the state-owned enterprise allows few companies to improve product quality so as to attract customers as well as

enhancing their competitiveness. Overall, the Ningbo industry cluster is competitive and dynamic in terms of all the dimensions.

The most important implication of this study is to provide insights on the Ningbo industry cluster competitiveness on smart water meter industry. Investors, companies and government may use this as a reference for them to better understand the cluster from different dimensions according to the Porter Diamond Theory.

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**APPENDIX 1: INVITATION LETTER TO GOVERNMENT OFFICIALS  
(ENGLISH)**

**Enquiry about the Smart Water Meter & Industry Environment**

**Dear (Person Name + Job Title)**

***(Company's Name)***

My name is Parker Chan, project administrator in Centre for Measurement and Information Systems, Finland (CEMIS). I am responsible to research details about production of water meter in China

As such, I would like to invite you to participate in a telephone inquiry. The main objective of the discussion is to better understand the details of smart water meter in China and also the industry environment when investing in China.

This is a preliminary discussion to explore possibilities. The main objectives are to understand the general capabilities of your company like your products; labor and R&D. The expected duration is around 30-40 minutes.

Please email me back if you consent to participate in a telephone interview. Your help will be greatly appreciated. Thanks in advance.

**Mr. Parker Chan**

Project Administrator, **CEMIS**

Email: kbi10iparkerc@kamk.fi

**Mr. Al Natsheh Anas**

Senior Business Advisor, **CEMIS**

Tel: +358 44 7101 228

Email: anas.alnatsheh@cemis.fi

**Attached reference: CEMIS organization overview**

## APPENDIX 2: INVITATION LETTER TO GOVERNMENT OFFICIALS (CHINESE)

关于智能水表的洽谈-芬兰测量和信息系统中心

致（人名+工作头衔）

公司名称

您好！本人是芬兰测量和信息系统中心（CEMIS）海外项目部经理，负责考察中国智能水表的生产细节。我方曾浏览贵公司的网站，知悉贵公司在水表制造领域的专业性，故想深入了解你们的运作，继而探讨未来双方合作的机会。

我方希望您能今周内抽出时间让我们深入了解贵公司智能水表的产品及其生产环境，给我们以后的合作提供一个契机。

如果您能抽出30-40分钟与我洽谈，请回复电邮告知。

特此函询，不胜感激。

2013年10月21日

陈柏嘉 先生

海外项目部经理，CEMIS

电子邮件：kbi10iparkerc@kamk.fi

Anas Al Natsheh 先生

资深商业顾问，CEMIS

电话：+358 44 7101 228

电子邮件：anas.alnatsheh@cemis.fi

参考资料：CEMIS 中心简介

### APPENDIX 3: INVITATION LETTER TO COMPANIES (ENGLISH)

#### Enquiry about the Smart Water Meter & Industry Environment

Dear (Person Name + Job Title)

*(Company's Name)*

My name is Parker Chan, project administrator in Centre for Measurement and Information Systems, Finland (CEMIS). I am responsible to research details about production of water meter in China (and I read your website that you have water meter related products, especially the smart water meter.

As such, I would like to invite you to participate in a telephone inquiry. The main objective of the discussion is to better understand the details of smart water meter in China and also the industry environment when investing in China.

This is a preliminary discussion to explore possibilities. The main objectives are to understand the general capabilities of your company like your products; labor and R&D. The expected duration is around 30-40 minutes.

Please email me back if you consent to participate in a telephone interview. Your help will be greatly appreciated. Thanks in advance.

**Mr. Parker Chan**

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Email: anas.alnatsheh@cemis.fi

**Attached reference: CEMIS organization overview**

#### APPENDIX 4: INVITATION LETTER TO COMPANIES (CHINESE)

关于智能水表的洽谈-芬兰测量和信息系统中心

致（人名+工作头衔）

公司名称

您好！本人是芬兰测量和信息系统中心（CEMIS）海外项目部经理，负责考察中国智能水表的生产细节。我方曾浏览贵公司的网站，知悉贵公司在水表制造领域的专业性，故想深入了解你们的运作，继而探讨未来双方合作的机会。

我方希望您能今周内抽出时间让我们深入了解贵公司智能水表的产品及其生产环境，给我们以后的合作提供一个契机。

如果您能抽出30-40分钟与我洽谈，请回复电邮告知。

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参考资料：CEMIS中心简介



## **APPENDIX 5: INTERVIEW GUIDE FOR GOVERNMENT (ENGLISH)**

### **General Questions about the interviewee:**

- 1) What is your position in the government official?

### **General Questions about the Shanghai Industry Cluster – Labor**

- 2) What kind of average qualification does your line staff (staff level) & factory manager (management level) in water instruments manufacturing environment have in respectively?

### **General Questions about the Shanghai Industry Cluster – Company Structure**

- 3) What are the companies' sizes in the industry cluster? (mainly SMEs?)
- 4) What are the most common types of ownership? Are they mostly owned by government?
  - a.) Single Proprietorship
  - b.) Partnership
  - c.) Cooperative
  - d.) Corporation, privately held
  - e.) Corporation, listed on stock exchange
  - f.) Others, please specify

### **General Questions about the Shanghai Industry Cluster – R&D**

- 5) What kind of innovation infrastructure do you have (scientific research institutions/ availability of scientists and engineers)
- 6) What kind of technology level in the industry? (automation level)
- 7) Where do the sub-system/ ICT technology suppliers come from? Mainly from this region or from other region?

### **General Questions about the Shanghai Industry Cluster – Government support / Regulations**

- 8) Do you have regulations on companies in your industrial belt to provide continuous training and development to their employees?
- 9) What are the patent / trademark policies in protecting innovation?
- 10) What are the quality control (certifications) measures when selling abroad or domestically?
- 11) What kind of incentives do you provide to this industry?

□ Can I contact you again in case I want to clarify some of the information that you provide me in this interview? Thank you very much for your participation.

## **APPENDIX 6: INTERVIEW GUIDE FOR GOVERNMENT (CHINESE)**

### **基本数据**

1. 你的職位是什麼?

### **员工范围**

2. 智能水表行业一线员工和工厂管理者的学历属于哪个层次? (大专, 本科, 研究生, 博士)
3. 政府有对智能水表公司和员工进行考核吗?

### **公司結構**

4. 智能水表行业中哪种规模的企业占大多数? (中型企业还是小型企业)
5. 在智能水表 产业范围内是哪种所有权的公司最普遍? 他们都是国有企业吗? 独资企业; 合伙企业; 私人公司; 上市公司; 如果还有其他形式, 请详细注明

### **科学技术研究**

6. 智能水表产业在研究和发展方面有哪些技术和政策支持?
7. 生产零件的供应商和电子零件供应商源于何处? 主要来自国内还是国外?

### **政府支持**

8. 政府有哪些政策来保护产品商标以及专利?
9. 你们对销售到国内和国外产品的质量检测标准有何不同?
10. 你们会提供哪些福利政策去推动智能水表行业的发展?

当我想进一步了解你提供给我的信息时我能再次联系你吗?

谢谢你的参与!

## **APPENDIX 7: INTERVIEW GUIDE FOR COMPANIES (ENGLISH)**

### **General Questions about the interviewee:**

- 8) What is your position in the company?
- 9) What is your company size? How many workers are there in your company / factory?
- 10) Which type is your company ownership?
  - g.) Single Proprietorship
  - h.) Partnership
  - i.) Cooperative
  - j.) Corporation, privately held
  - k.) Corporation, listed on stock exchange
  - l.) Others, please specify

### **General Questions about your company – Product**

- 11) What are the qualifications (eg: CE) of your product? Who are the certification organizations?
- 12) Do you have your own R&D team to innovate products?
- 13) Do you sell your products to domestic market or foreign market? What countries?
- 14) Or do you work as a subcontractor?

### **General Questions about your company – Labor**

- 15) What kind of average qualification does your line staff (staff level) & factory manager (management level) in your company have in respectively?

### **General Questions about your company – R&D**

- 16) What kind of innovation infrastructure do you have (scientific research institutions/ availability of scientists and engineers)
- 17) Where do your sub-system/ ICT technology suppliers come from? Mainly from this region or from other region?
- 18) Do you have some training programs in your company to provide continuous training and development to your employees?
- 19) Do you have any patent / trademark policies in protecting innovation?

☐ Can I contact you again in case I want to clarify some of the information that you provide me in this interview?

Thank you very much for your participation.

## **APPENDIX 8: INTERVIEW GUIDE FOR COMPANIES (CHINESE)**

### **基本数据**

1. 你的职位是什么?
2. 你们公司属于大型企业，中型企业还是小型企业？你们公司有多少员工？
3. 你们公司是那种所有权形式？独资企业；合伙企业；私人公司；上市公司；如果还有其他形式，请详细说明

### **产品**

4. 你们的产品有什么的资格证书 (CE)? 哪些机构发这些证书给你们
5. 你们有自己的产品设计团队吗
6. 你的水表主要是销售到国内或是国外?有哪些国家?或是你是以一个承包商形式生产?

### **员工范围**

7. 你们的一线员工和工厂管理者的学历属于哪个层次？（大专，本科，研究生，博士）

### **科学技术研究**

8. 你们有什么科学技术研究的设施？例如有没有一研究队伍或跟大学合作
9. 你们工厂配备哪些级别的生产机器自动化水平 (全部工序都自动化生产吗?)
10. 生产零件的供应商和电子零件供应商源于何处？主要来自国内还是国外？
11. 公司会对员工进行哪些日常培训？
12. 你们有什么政策来保护产品商标以及专利？

当我想进一步了解你提供给我的信息时我能再次联系你吗？

谢谢你的参与！

## **APPENDIX 9: COMPANY PROFILE - COMPANY A**

### **Company Basic Details:**

- >1200 staff
- R&D staff 350
- Annual production: 20 million units
- Sales revenue over 1 billion RMB
- Case/ Project participated: Bird's Nest, National Stadium, China; Water Cube, National Aquatics Center, China; National Centre for the Performing Arts
- has 29 sub-companies, 2,600 sales-nets in domestic market as well as 7 sales branches in the world. owns more than 1300 clients, which is the top-list in china.
- >30 years history of professional manufacture

### **Company Type:**

- Private Limited Company
- Transformed from a state-owned enterprise in 2005

### **Domestic?**

- Domestic; European; Russian Companies

### **OEM?**

- ✓OEM

### **Products Types:**

- Our products range covers valves, water meters, sanitary-hardware, faucets, shower rooms, bathroom-cabinets, stainless steel sinks, and fittings and so on with more than 6,000 kinds
- Water Meter, Steel Sinks, Bathroom Cabinets, Kitchen Ware, Shower Series

### **Qualification:**

- ISO9001:2000

- ISO9002→ strict process control documents on raw materials procurement, product design, parts processing, and performance testing, packaging and other aspects.
- ISO14001
- **AS** certification: EG: AS3688, AS3718, AS-MP52
- **CE** certificates of product quality in 2001
- Some of products achieved **UL** and **KS** certificates; **KS certification** issued by the **Korean Standard Association**
- **CEC environment certification**
- Product dispatch from the **factory qualification rate is 100%**, the **export commodity inspection qualification rate is 100%**.
- **Certifications from the industry association**, for instance, the Chinese Hardware Fittings Construction Association, certifying that the product has a stable and reliable quality
- In 2006, awarded the **“Certificate for Produce Exemption from Quality Surveillance Inspection”** from the General Administration of Quality Supervision, Inspection and Quarantine of the People’s Republic of China
- It refers to a company’s certain product can be exempted from the quality surveillance inspection from the Chinese government within a certain period of time. However, consumer have the rights to challenge the product quality if there is something wrong with the product through the local bureau of quality and technical supervision department
- Requirement: First, the company must be a legal person. Second, the product must be produced continually two or above years without any quality inspection fail case inspected from the government. Third, the company is fulfilling the criteria of the ISO9000, meaning that the company has a comprehensive quality management. Fourth, the product must have a high ranking in terms of market share and economics of scale. (General Administration of Quality Supervision, Inspection and Quarantine of the People’s Republic of China )
- **Certifications from the industry association**, for instance, the Chinese Hardware Fittings Construction Association, certifying that the product has a stable and reliable quality

#### **Product Suppliers:**

- China

#### **Patent & Trademark**

- Patent
- Trademark
- In 2008, granted the Zhejuang Famous Trademark Certificate
- In 2009, it passed the inspection from Zhejiang Bureau of Quality and Technical on the examination in manufacture of measurement tools. The inspection areas are mainly, production environment; management; technique and quality control

## **R&D**

### **Technology Level?**

- Advanced ARL spectrometer in 2001 from Switzerland, which is used for raw materials analysis
- Advanced and high precision and professional metal process machines 400 sets, such as Italian heating press machine, gravity casting machine and Toshiba casting machine, there are 58sets of advanced testing equipment or checking assembly line, equipped with 26 piece standard machines

### **Own R&D team?**

- In October 2004, Ningbo Quality Supervision and Inspection institute of products quality put the "Sanitary products testing Center of Ningbo" locate in the AMICO company's testing room

### **Labor qualification**

- Research and Technology Staff: Bachelor
- Factory staff: working experience required

### **Training?**

- Company A values “human resources” as their company’s most-valuable assets
- For sales team, they have training session held by the company for their distributor to better enhance their knowledge on Amico’s product, quality and sales service. After the course, they would receive a certificate from the **Amico Group Management School**
- Audit test every year for staff evaluation, including the technology staff, areas are audited such as work performance to determine whether they are qualified to continue for working

- The **Amico Online Business School**, founded in 2009, offer courses, such as management, production, finance, human resource, IT, etc, up to 722 course units.
- **Cooperation with Zhejiang Worker's University of Economic Management**, a university specialized for adult education, special for Amico's staff to study business management.
- Annually, there are more than 30 training sessions **held by the human resource department**, more than 1200 staff are trained. The expenditure is around 500 000 RMB per year.
- Guaranteed training quality: drafting year plan for training program→progress evaluation; quality-checking of lecturers by the human resource department
- **Compulsory training program for new-comers, especially for those quality control staff**; Training program content: Technology; Safety; Industry information; Law and etc.
- They have established their **own training system**. Each year will have a training theme.  
EG: Quality Control→aim to improve company's quality control aspect



## **APPENDIX 10: COMPANY PROFILE – COMPANY C**

### **Company Basic Details:**

- A water meter company combining research; application; and trading

### **Company Type:**

- Private Limited Company

### **Customers:**

Domestic water supplies Company, industrial and mining enterprises; real estate companies

### **Domestic?**

- Mainly domestic

### **OEM?**

- N/A

### **Products Types:**

- Selling “NB” brand water meter
- Providing after-sales service

### **Qualification:**

- Production License of Industrial Products
- ✕iso9001

### **Product Suppliers:**

- N/A

### **Patent & Trademark**

- ✓ Patent & ✓Trademark

## **R&D**

### **Technology Level?**

- Partly automation; partly labor manufacturing

### **Own R&D team?**

- ✓ R&D team, corporation with Company B.

### **Labor qualification**

- N/A

### **Training?**

- N/A

## **APPENDIX 11: COMPANY PROFILE – COMPANY E**

### **Company Basic Details:**

- Water Meter Components Supplier
- Annual production 4 million units

### **Company Type:**

- Private Limited Company

### **Customers:**

- Water Meter Company from China
- EG: Company B., Company A. , Jiangxi Gan River Water Meter Co., Ltd., Wasion Group

### **OEM?**

- N/A

### **Products Types:**

Water Meter Components

### **Qualification:**

- ISO 4064

### **Product Suppliers:**

- Own-produce

### **Patent & Trademark**

✱Patent or Trademark

### **R&D**

### **Technology Level?**

- Partly automatic production; partly labor manufacturing (assembling part)

**Own R&D team?**

- ✓R&D team to develop own water meter components

**Labor qualification**

- N/A

**Training?**

- N/A

## **APPENDIX 12: COMPANY PROFILE - COMPANY F**

### **Company Basic Details:**

- Factory size: 2500m<sup>2</sup> company size

### **Company Type:**

- Private Limited Company

### **Customers:**

Hohhot Home Landscape (IC card water meter; Baoding Water Company (IC card water meter, mainly offices, communities, buildings, housing estate

### **Domestic?**

- Domestic, African and Middle-east markets

### **OEM?**

- N/A

### **Products Types:**

- Mechanical Water meter series, IC card water meter series, wireless remote meter series, wireless valve water meter series, etc.

### **Qualification:**

- ✓ ISO14001, ISO9001:2000 ISO4064、CJ/T133-2007、CJ/128-2007 standard

### **Product Suppliers:**

- N/A

### **Patent & Trademark**

- ✓ Patent: over 90% of products have own patent

- ✓ Trademark

## **R&D**

### **Technology Level?**

- N/A

### **Own R&D team?**

- Own Chief Engineer Department (Technology & Quality department)→ measuring room & testing room in technology department; qc inspection; production inspection; foreign co-inspection team
- Cooperation with local universities, EG: Ningbo University

### **Labor qualification**

- Not all engineers possesses Master degree or above

### **Training?**

- Regular labor training program

## **APPENDIX 13: COMPANY PROFILE - COMPANY G**

### **Company Basic Details:**

- Selling “NB” brand water meter from Company B, providing sales services for those water meters

### **Company Type:**

- Private Limited Company

### **Domestic?**

- N/A

### **OEM?**

- N/A

### **Products Types:**

- 1) Industrial uses: remote meter, portable meter calibrator, flow transmitters; meter reading system,
- 2) Non-industrial uses: IC card water meter, pulse sender water meter, heat meter

### **Qualification:**

- ISO4064B

### **Product Suppliers:**

- N/A

### **Patent & Trademark**

- N/A

### **R&D Technology Level?**

- N/A

### **Own R&D team?**

- N/A

### **Labor qualification**

- N/A

### **Training?**

- N/A

## **APPENDIX 14: COMPANY PROFILE - COMPANY D**

### **Company Basic Details:**

- A water meter company, found in 1997, combining R&D, production, sales
- Able to develop own IC card water meter of both hardware and software parts
- Factory size: 24000 m2
- Annual production for IC card water meter: 800 000 units

### **Company Type:**

- Private Limited Company,

### **Customers:**

- Domestic: Beijing, Jiangsu, Hebei, etc.

### **OEM?**

- ✓Provide: OEM service

### **Products Types:**

- Own “Longkang” brand water meter; IC card water meter; remote meter, etc.
- Supply water meter components for other smart water meter companies

### **Qualification:**

- Passed the technology assessment from Ministry of Housing and Urban-Rural Construction of the People's Republic of China→meaning that the product has high domestic standard in China
- In 2004, the “LongKang” brand IC card water meter was listed as a “suggested product” by Ministry of Housing and Urban-Rural Construction of the People's Republic of China for construction of housing estate.
- EG: Technical Standard CJ/T133-2001; GB/T778.
- Maximum error tolerance standard GB/T778.1B



**Product Suppliers:**

- N/A

**Patent & Trademark**

- Patent: more than 20 types of IC card water meter design patent
- developed water-pipe valves motivated by electronic cell

**R&D - innovation Facilities**

- Own production quality control system
- 250 water meter check point
- Functionality test and equipments
- Developed their own performance index for evaluating product quality→reliability & maintain high quality

**Technology Level?**

- Import production machine from overseas for molding, precise material processing, assembling

**Own R&D team?**

- ✓Own R&D team developed over 17 water meter type and 108 products

**Labor qualification**

- N/A

**Training?**

- N/A

## **APPENDIX 15: COMPANY PROFILE – COMPANY B**

### **Company Basic Details:**

- founded in 1958.
- It is the leading enterprise of China Water Meter Industry as well as the biggest Water Meter manufacturing and exporting base.
- NB brand
- Annual production: 600 million units
- Factory Area: 45000 m<sup>2</sup>

### **Company Type:**

- Private Limited
- In 2000, approved by Ningbo People's Government. Company reform from the state-owned factory to the private company for the establishment of Ningbo Water Meter Co., Ltd.

### **Domestic?**

- over 50 countries throughout the world (including Russia)
- 10% of global water meter trade volume is from NB water meter, 45% of China water meter export volume is from NB water meter.
- In 2010, the smart water meter production unit is 5.8 million units, valued 48 million RMB. The breakdown of the production unit is 1.78 million units to export, domestic sales counts for 4 million units

### **OEM?**

- OEM & ODM

### **Products Types:**

- There are totally more than 500 varieties of water meters ranging from 8mm to 500mm.
- extensive range of water meters for residential, industry and agricultural applications with advanced technology from the size 1/2" (Dn15) to 20" (Dn500), automatic reading system, intelligent water meter, test bench of water meter

**Qualification:**

- ISO, AWWA standards, Australia National Standard.... Our system is certified by ISO9001: 2000 Quality System Certification; ISO10012: 2003 Measurement System Certification; ISO14000: 2004 Environmental Management System Certification.
- CE for European standard
- Participated in modifying National Standard, GB/T778.1 ~ 3-2007 closed pipe water meter CJ/T133-2007 IC card water meter, CJ/T224-2006 electronic remote meter, CJ/T241-2007 drinking water meter, etc.
- In 2004, first time won the “Certificate for Product Exemption from Quality Surveillance Inspection”.
- The products successively won the title of Golden & Silver Medal of National High Quality, China Top Brand, Chinese well-known trademark and National High Technology Enterprise.

**Product Suppliers:**

Domestic

**Patent & Trademark**

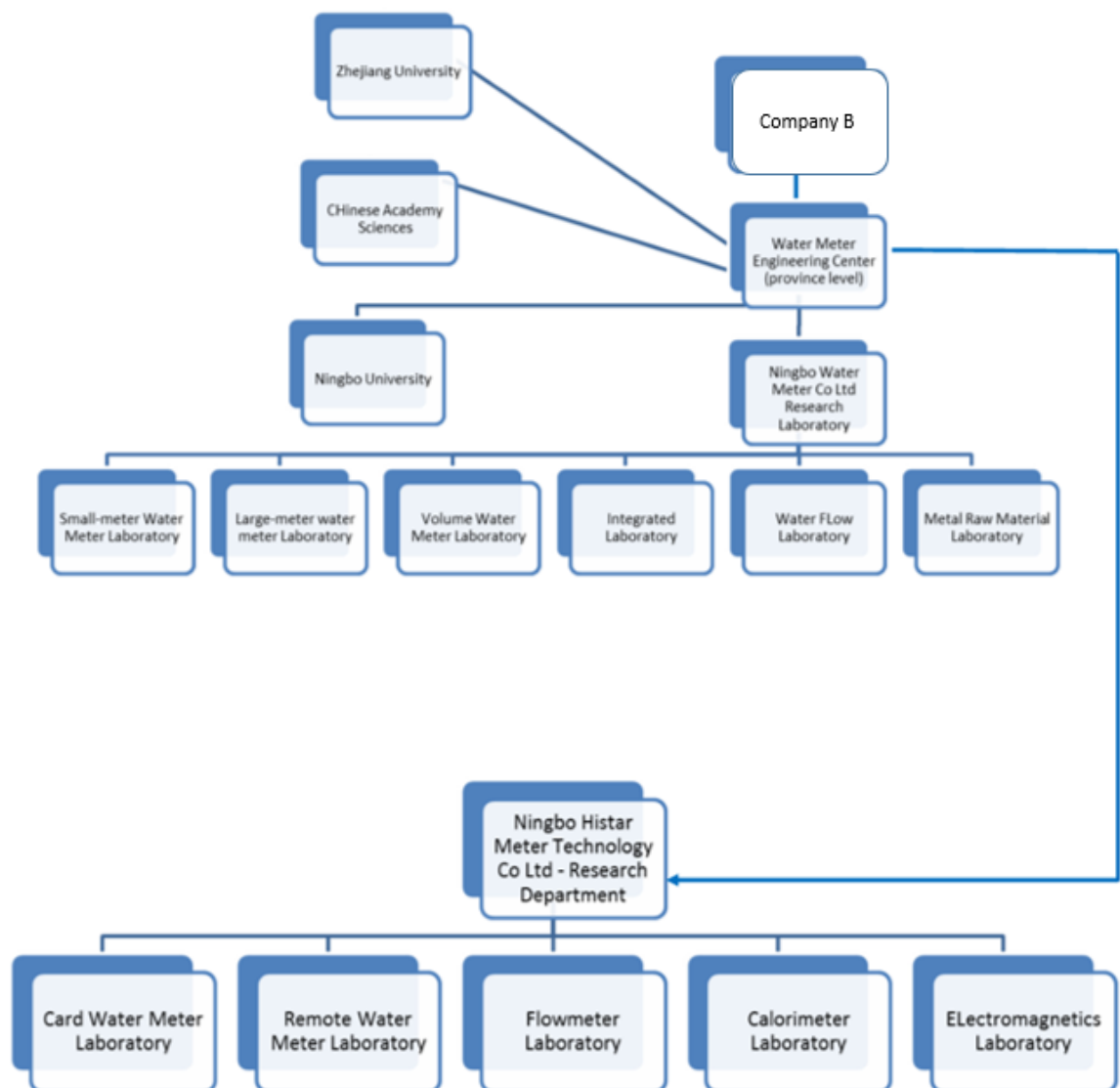
- ✓Patent, around 20 patent application per year, EG: automatic meter reading system; high-precision water flow detection device
- ✓Trademark; in 2001, NB trademark as well-known trademark licensed by Zhejiang Administration of Industry and Commerce, and maintain so far.
- In 2003, first time won the "China Top Brand".

**&D**

- Engineering Department→Quality Control team & R&D team
- In 2008, R&D expenditure is 1613 million RMB, which counts 3.2% of the sales revenue.
- Smart meter and system: TM card / IC card prepaid water meters and water system
- Software copyright: EG: TM card prepaid water meter Embedded System V1.0
  
- Company B set up a water meter engineering center at the provincial level, equipped with various types of advanced scientific research facilities, continuously specializes in

innovative water measurement technologies, developing, manufacturing. The center is 1200 m<sup>2</sup> and the investment is 2500 million RMB (~300 million euro). It has a product design studio, laboratory, standardized data collection room, and product trial workshop.

- Cooperation with Zhejiang University, Ningbo University, Ningbo Institute of Materials Technology and Engineering (NIMTE), the Chinese Academy of Sciences (CAS) and other universities and research institutions→establish a wide range of technical cooperation
- Applying modern advanced electronic technology, computer network technology, modern communications technology to improve functions of water meter



*Figure showing Company B Research Team*

### **Technology Level?**

- Quality control testing in every production stage, from Raw material purchasing, product manufacturing, functionality test to packaging
- Positive feedback from General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China(AQSIQ)
- Got Zhejiang Quality Management Award in 2006

### **Own R&D team?**

- ✓ R&D team

### **Labor qualification**

- Production management: Bachelor or above; Quality Control: Bachelor or above
- Technology Supervisor: Professor; Laboratory vice manager: Master; Engineer: Master
- The percentage of average qualification for technique staff is bachelor degree or above is around 30%.
- 20% of the staff is from R&D team.

### **Training?**

- N/A

## **APPENDIX 16: COMPANY PROFILE – COMPANY X**

### **Company Basic Details:**

- Staff: 200, Technique Staff 80%
- Annual production value: 50 million RMB
- Research, Manufacturing, Sales and service of smart water meter and water stand
- >20 years experience

### **Company Type:**

- Private Limited Company

### **Domestic?**

- South East Asia; Europe; America; Domestic

### **OEM?**

- N/A

### **Products Types:**

- Smart IC card water control system, remote water meter, stainless steel water meter

### **Qualification:**

- awarded by General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, second grade enterprise certification, Guangdong Province
- ISO9001: 2008
- UN qualified suppliers
- National standard: IC card water meter: GB/T778.1-2007; CJ/T133-2001

### **Product Suppliers:**

- N/A

### **Patent & Trademark**

- ✓ Patent & ✓ Trademark

## **R&D**

### **Technology Level?**

- Automation manufacturing

### **Own R&D team?**

- Cooperate with universities, EG: South China Normal University; South China University of Technology

### **Labor qualification**

- N/A

### **Training?**

- Seminars; Staff Training; Measurement Training

## **APPENDIX 17: COMPANY PROFILE – COMPANY Y**

### **Company Basic Details:**

- Year founded: 2002
- Brand Name: Wing Tung
- Registered capital: 1 million RMB (~120 000 Euro)
- Staff: 200 people, R&D staff: 120 people around
- Annual sales: 10 million RMB (~1 200 000 Euro)
- Annual production 5000 units
- Factory area: 3000m<sup>2</sup>

### **Company Type:**

- Private Limited Company

### **Customers:**

- Domestic – Schools & Factories

### **Domestic?**

- Domestic

### **OEM?**

- N/A

### **Products Types:**

- Household water purifier, water dispenser, IC card water control tables, smart meter and other products.

### **Qualification:**

- ISO9001; Internal Quality Control

### **Product Suppliers:**

- Domestic

### **Patent & Trademark**

- ✓ Patent & ✓ Trademark



## **R&D**

### **Technology Level?**

- Assemble by labor

### **Own R&D team?**

- Senior engineers with Chinese national qualifications
- Developed own software and hardware for water meter
- Cooperation with South China University of Technology to develop water meter

### **Labor qualification**

- N/A

### **Training?**

- Regular labor training program;
- Compulsory training program for new comers

## **APPENDIX 18: COMPANY PROFILE – COMPANY Z**

### **Company Basic Details:**

- N/A

### **Company Type:**

- Private Limited Company

### **Domestic?**

- Domestic water supply company

### **OEM?**

- N/A

### **Products Types:**

- Digital water meter with software use

### **Qualification:**

- measurement equipment manufacturing license;

### **Product Suppliers:**

- N/A

### **Patent & Trademark**

- Patent & Trademark
- Utility-design patent for digital water meter

### **R&D Technology Level?**

- N/A

### **Own R&D team?**

- ✓ own R&D team

### **Labor qualification**

- N/A

### **Training?**

- N/A

## **APPENDIX 19: COMPANY PROFILE – COMPANY Q**

### **Company Basic Details:**

- Annual production: 1 million units
- Factory size: 3600m<sup>2</sup>
- Fixed assets: 5 million RMB

### **Company Type:**

- Private Limited Company

### **Domestic?**

- N/A

### **OEM?**

- N/A

### **Products Types:**

- Remote water meter, magnetic water meter, multi-stream water meter

### **Qualification:**

- ISO9001:2000; ISO 4064

### **Product Suppliers:**

- N/A

### **Patent & Trademark**

- N/A

### **R&D Technology Level?**

- N/A

### **Own R&D team?**

- N/A

### **Labor qualification**

- N/A

### **Training?**

- N/A

## **APPENDIX 20: COMPANY PROFILE – COMPANY T**

### **Company Basic Details:**

- Manufacturing, sale & service, Installation of water meter
- Capital 7.22 million RMB

### **Company Type:**

- State-owned Enterprise

### **Domestic?**

- Domestic only in Shanghai, selling to Shanghai water supply companies

### **OEM?**

- N/A

### **Products Types:**

- N/A

### **Qualification:**

- ISO-9001
- ISO-4064
- GB/T19001-2000
- Scope: Design, manufacture, sale and service of water meter

### **Product Suppliers:**

- N/A

### **Patent & Trademark**

- N/A

### **R&D Technology Level?**

- N/A

### **Own R&D team?**

- N/A

### **Labor qualification**

- N/A

### **Training?**

- N/A

## **APPENDIX 21: COMPANY PROFILE – COMPANY W**

### **Company Basic Details:**

- Staff: 50; Annual sales 5million RMB
- Customer: Chemical Industry, Manufacturing factory
- Factory size: 2000m<sup>2</sup>
- Annual production 30000 units
- Founded in 2008

### **Company Type:**

- Private Limited Company

### **Domestic?**

- Domestic & South East Asia

### **OEM?**

- No

### **Products Types:**

- Pressure meter series, temperature meter series, flow meters, metal sleeve thermometer, glass thermometer liquid

### **Qualification:**

- Production License → Fengxian District of Shanghai Municipal Bureau of Quality and Technical Supervision
- Organizational Code Certificate → General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China

### **Product Suppliers:**

- N/A

### **Patent & Trademark**

- N/A

## **R&D**

### **Technology Level?**

- N/A

### **Own R&D team?**

- 5-10 staff R&D team

### **Labor qualification**

- N/A

### **Training?**

- N/A

## **APPENDIX 22: SHANGHAI INDUSTRY CLUSTER REFERENCE MATERIALS**

### **Overview of Shanghai**

Shanghai, one of the four province-level municipalities in China, is a major financial center in China. It is the largest city by population in China. It is located in the Yangtze River Delta in East China. Shanghai is one of the key industrial cities in China. It has several industrial zones, including SHnanghai Hongqiao Economic and Technological Development Zone, Jinqiao Export Economic Processing Zone, Minhang Economic and Technological Development Zone, and Shanghai Caohejing High-Tech Development Zone.

### **CaoHeJing Hi-Tech Park**

It is an industrial park that is specific for hi-tech industries. The park is mainly developed for supporting ICT related industries – Examples are Bio-medic, Sustainable energy, Automobile development and Astronautics Engineering. There are more than 500 enterprises in there to provide ICT production support; example products are the IC design, manufacturing and chips.

*Contact Details: Telephone: 86-21- 64850000*

*Website: <http://www.caohejing.com/Default.aspx>*

### **Logistics**

Shanghai has an extensive transportation network connecting within China and the global. Shanghai is a major hub of China's expressway network. Many national expressways (prefixed with G) pass through or terminate in Shanghai, such as G2 Beijing–Shanghai Expressway (overlapping G42 Shanghai–Chengdu), G15 Shenyang–Haikou, G40 Shanghai–Xi'an, and etc. On the other hand, Shanghai is one of the leading air transport gateways in Asia. The city has two commercial airports: Shanghai Pudong International Airport (mainly international flights) and Shanghai Hongqiao International Airport (Domestic flights mainly)

## **APPENDIX 23: GUANGZHOU INDUSTRY CLUSTER REFERENCE MATERIALS**

### **Overview of Guangzhou**

Guangzhou, located in the southern part of the mainland China, is one of the five National Central Cities and a key national transportation hub and trading port. Located in the Pearl River Delta and being the capital of Guangdong Province, It holds sub-provincial

administrative status, meaning that Guangzhou is governed by Guangdong province but is administered independently in regard to economy and law.

### **Logistics**

Guangdong is the transportation hub of the South China. And Guangzhou has an advanced network covering in all directions over the sea, land and air. First, the Port of Guangzhou is the main seaport of Guangzhou. It is now the largest comprehensive port in South China. Its international maritime trade reaches over 300 ports in more than 80 countries in districts worldwide. Many industrial and manufactured products are shipped through this port and it is a crucial transport hub for industries located in neighboring provinces such as Hubei and Jiangxi. Second, the air transport in Guangzhou is essential as well. Guangzhou Baiyun International Airport, one of the Top Three Air Hubs of China, was the China's third busiest cargo traffic airport in 2012. One of the famous logistic companies, FedEx Express has relocated their Asia-Pacific hub, a cargo company facility enabling FedEx to control aircraft movements on the ground, aircraft parking plans as well as loading and unloading priorities, to the Baiyun airport from Philippines. It provides delivery services among 20 major cities in Asia and linking these cities to more than 220 countries and territories in the world. Examples of cargo airlines include Fedex Express, Lufthansa Cargo and Turkish Airlines.

Third, Guangzhou is the railway hub of the southern China as well. Guangzhou East Station is the biggest railway station and the most important transport hub in Guangzhou. It has both passenger and cargo railways with 1 million tons of cargo transported annually. Its network is extensive, connecting to Shenzhen, Beijing and Hong Kong.

### **Industry Parks in Guangdong**

There are multi-layer, diverse and modern investments undertaking platforms in Guangdong. The whole province owns 6 national economic & technical development zones including Guangzhou Economic & Technical Development Zone, Zhanjiang Economic & Technical Development Zone, Nansha Economic & Technical Development Zone, Dayawan Economic & Technical Development Zone and Zengcheng Economic & Technical Development Zone, 9 national hi-tech industrial development zones , 17 bonded logistics supervision areas/ sites, 36 provincial industry relocation industrial parks, and a batch of provincial development zones.



### **Guangzhou Science City**

According to the *Planning Framework of the Reform and Development of the Pearl River Delta Area (2008- 2020)*, one of the general direction of developing this Pearl River Delta region is to strengthen the capabilities of independent innovation. The state encourages the enterprises to increase their R&D input to consolidate the role of domestic enterprises as the main players of independent innovation. For instance, launching preferential policies for independent innovation - pre-tax deduction of R&D expenses of enterprises; supporting enterprises to cooperate with universities and research academies throughout the country to establish high-level technological research institutions and talents development institutions; organizing enterprises technological centers; and undertaking national major scientific and technological projects. Emphasis will be giving from the region to the 50 national-level and 10 world leading key innovative enterprises that are with strong innovating capabilities and economic profitability.

### **Nansha New District & Sino-Singapore Knowledge Town**

There are two pivotal cooperation platforms in Guangzhou which may related to the smart meter industry - Nansha New District in Guangzhou, and Sino-Singapore (Guangzhou) Knowledge Town— The former one aims to serve the mainland and connect Hong Kong, and it is planned to be built into a commercial service center, technology innovation center, education and training base, bulk commodity exchange center, key logistic base in Southern China. The latter one aims to develop areas covering R&D service, innovation industry, education and training, life and health, information technology, biotech, energy, resource and environment protection and advanced manufacturing.

## **APPENDIX 24: CERTIFICATIONS**

### **i) Chinese Standards and/or Organization(s)**

In China, the standards may be either mandatory or voluntary. The former have the force of law so as other technical regulations in China. They concern the protection of social wealth, such as human health, personal property and safety, and are enforced by laws. Voluntary standards are those which do not possess these features.

The Chinese standards consist of four levels – National Standards; Professional Standards; Professional Standards; Local Standards; Enterprise Standards. They are hierarchical, for instance, the local standards supersede enterprise standards, professional standards supersede local standards, etc. One type of Chinese standard will apply for any given product or service. ([http://www.standardsportal.org/usa\\_en/prc\\_standards\\_system/standards\\_used\\_in\\_china.aspx#enterprise](http://www.standardsportal.org/usa_en/prc_standards_system/standards_used_in_china.aspx#enterprise))



#### **a) National Standards**

National Standards are referred to as “GB standards”. They are consistent across the whole China and are developed for technical requirements. They can be identified as mandatory or voluntary by their prefix code, as followed by the table below. Also, many GB standards are

adopted from ISO or other international standards developers. As of 2006, not more than half of all GB standards were adopted from international standards.

Code	Content
GB	Mandatory National Standards
GB/T	Voluntary National Standards
GB/Z	National Guiding Technical Documents

#### **b) Professional Standards**

Professional Standards are referred to as “Industry Standards”. They are developed and used as no National GB Standard exists, but a unified technical requirement is needed for a specific industry sector in China. They are coded by industry sector (Codes of mandatory standards are shown in the below table). Voluntary standards have “/T” after the mandatory codes. For instance, the code for urban construction voluntary standards is “CJ/T”

Code	Content
BB	Packaging
CB	Ship
CH	Surveying
CJ	Urban construction
CY	Press and publication
DA	Archives
DB	Earthquake
DL	Power
DZ	Geology mineral
EJ	Nuclear industry
FZ	Textiles
GA	Public security
GY	Radio, film & TV
HB	Aviation
HG	Chemical Industry
HJ	Environmental Protection
HS	Customs
HY	Ocean
JB	Machinery
JC	Building materials
JG	Construction industry
JR	Finance
JT	Communication
JY	Education
LB	Tourism
LD	Labor and labor safety
LY	Forestry
MH	Civil aviation
MT	Coal

Code	Content
MZ	Civil affairs
NY	Agriculture
QB	Light industry
QC	Automobiles
QJ	Space
QX	Meteorology
SB	Commerce
SC	Water product
SH	Petrol chemical industry
SJ	Electronics
SL	Water resources
SN	Commodity inspection
SY	Petroleum gas
SY(>10000)	Oceanic petroleum gas
TB	Railways transportation
TD	Land administration
TY	Sport
WB	Goods
WH	Culture
WJ	Civil products from arms industry
WM	Foreign trade
WS	Hygiene
XB	Rare earth
YB	Ferrous metallurgy
YC	Tobacco
YD	Telecommunication
YS	Non-ferrous metallurgy
YY	Medicine
YZ	Posts

### c) Local Standards

Local Standards are often referred to as “Provincial Standards”. They are developed when the above two standards are unavailable, but unified requirements for safety and hygiene of industrial products are needed within a local region. The codes are shown below table. The \* represents the province code as defined by the ISO 3166-2:CN and GB 2260/T. For instance, a local voluntary standard in Sichuan Province would be DB + 51/T.

Code	Content
DB + *	Mandatory local standards
DB + */T	Voluntary local standards

#### d) Enterprise Standards

Enterprise Standards may be developed and used by an individual company in China if the above three standards are not available. The Enterprise Standard code can be presented as below, where the \* represents the Enterprise code.

Code	Content
Q + *	Enterprise standards

#### e) General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ)

The General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) is the administration of the standards system in China, and the AQSIQ is headed primarily by Standardization Administration of the People's Republic of China (SAC).

Directly under the supervision of the State Council of the People's Republic of China, AQSIQ handles various activities in the areas of quality, metrology, entry-exit commodity inspection, entry-exit health quarantine, entry-exit animal and plant quarantine, certification and accreditation, and standardization.

#### f) Standardization Administration of China (SAC)

The Standardization Administration of the People's Republic of China (SAC) was established in 2001 by the State Council and is administered by AQSIQ. SAC is the Chinese National Standards Body and takes part in several standards-related activities, such as development and implementation of state laws and policies related to standardization; management of scientific & technical work related to standardization, including administration of technical committees; registration of sector and local standards, etc.

#### **g) China Quality Certification Centre (CQC)**

China Quality Certification Centre (CQC) is a professional certification body under China Certification & Inspection Group (CCIC) approved by State General Administration for Quality Supervision and Inspection and Quarantine and Certification and Accreditation Administration of the People's Republic of China.

It is the largest professional certification body in China. The core business involves product certification, including China Compulsory Certification (CCC), voluntary certification, management system certification and certification training services. In addition, they are also a state authorized third-party certification body for certification of energy saving, water saving and environmental friendly products.

CQC is a national certification body (NCB) in IECEE CB system and an official member of China in IQNet, IFOAM, ANF and CITA. In addition, they have established cooperative relations with 27 certification bodies from 19 countries and regions. For instance, they are officially authorized by the Japanese government to offer compulsory product certification (PSE) service for Japanese products.

#### **ii) Korean Standards and/or Organization(s)**

##### **Korea Industrial Standards (KS)**

KSA is an organization that provides both standardization and quality management training and education in Korea, and it implements a variety of researches and activities related to standardization and quality management in order to build a global standard that can live up to Korea's tradition as a great power in standards. It is the official distributor of Korean Industrial Standards (KS) ([http://www.ksa.or.kr/eng/eng01\\_01.jsp](http://www.ksa.or.kr/eng/eng01_01.jsp))

#### **iii) US Standards and/or Organization(s)**

##### **UL Standards (USA)**

UL Standards are used to assess products; test components, materials, systems and performance; and evaluate environmentally sustainable products, renewable energies, food and water products, recycling systems and other innovative technologies.

UL (Underwriters Laboratories) is a safety consulting and certification company headquartered in Northbrook, Illinois. It provides safety-related certification, validation, testing, inspection, auditing, advising and training services to a wide range of clients, including manufacturers, retailers, policymakers, regulators, service companies, and consumers.  
(<http://www.ul.com/global/eng/pages/solutions/standards/about/>)

#### **iv) Australian Standards and/or Organization(s)**

##### **Standards Australia (AS)**

Standards Australia is a non-government Standards organization. It is charged by the Commonwealth Government to meet Australia's need for contemporary, internationally aligned Standards and related services. It leads and promotes a respected and unbiased Standards development process ensuring all competing interests are heard, their points of view considered and consensus reached.

(<http://www.standards.org.au/OurOrganisation/AboutUs/Pages/default.aspx>)

#### **vi) Global Standards and/or Organization(s)**

##### **International Organization for Standardization (ISO)**

International Organization for Standardization (ISO) is the world's largest developer of voluntary International Standards. International Standards give state of the art specifications for products, services and good practice, helping to make industry more efficient and effective. Developed through global consensus, they help to break down barriers to international trade.

##### **ISO14001**

ISO 14001 is the framework for environmental management systems that helps companies both to manage better the impact of their activities on the environment and to demonstrate sound environmental management. It addresses not only the environmental aspects of organizations processes, but also those of its products and services. Using ISO 14001:2004 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved.

([http://www.iso.org/iso/theiso14000family\\_2009.pdf](http://www.iso.org/iso/theiso14000family_2009.pdf))

##### **ISO 9000 – Quality Management**

The ISO 9000 family focus various aspects of quality management. It provides guidance and tools for companies who want to ensure that their products and services consistently meet

customer's requirements, and that quality is consistently improved. There are many standards in the ISO 9000 family, such as ISO 9001:2008 (sets out the requirements of a quality management system) and ISO 9000:2005 (covers the basic concepts and language). Moreover, the standard is based on a number of quality management principles including a strong customer focus, the motivation and implication of top management, the process approach and continual improvement.

([http://www.iso.org/iso/home/standards/management-standards/iso\\_9000.htm](http://www.iso.org/iso/home/standards/management-standards/iso_9000.htm))

#### **v) European Standards**

##### **CE (Conformité Européenne)**

CE (Conformité Européenne) marking is a key indicator of a product's compliance with EU legislation and enables the free movement of products within the European market. It states that the product is assessed before being placed on the market and thus satisfies the legislative requirements to be sold there. It means that the manufacturer has verified that the product complies with relevant essential requirements of the applicable directive.

(<http://ec.europa.eu/enterprise/policies/single-market-goods/cemarking/>)



## APPENDIX 25: RESEARCH GUIDE ON CHINESE RELATED MATERIALS

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## APPENDIX 26: CHINESE WATER EXHIBITION LIST

<u>Name of exhibition</u>	<u>Date</u>	<u>Place</u>	<u>Exhibits</u>	<u>Website</u>
Water Expo China + Water Membrane China	2-4 DEC 2013	National Convention Center, <b>Beijing</b> China	<ul style="list-style-type: none"> <li>• Water solution and service provider</li> <li>• Wastewater treatment and equipment</li> <li>• Water information, automation and apparatus</li> <li>• Pumps, valves, pipes and fittings</li> <li>• Water resource</li> </ul>	<a href="http://www.messefrankfurt.com.hk/fair_homepage.aspx?fair_id=32&amp;exhibition_id=35&amp;hdnLang=en">http://www.messefrankfurt.com.hk/fair_homepage.aspx?fair_id=32&amp;exhibition_id=35&amp;hdnLang=en</a>
China International Water Treatment Show	26-28 MAR 2014	National Convention Center, <b>Beijing</b> China	3 exhibit zones: POU, sewage/wastewater treatment, membrane and pump&valve.	<a href="http://www.waterex.com.cn/en/">http://www.waterex.com.cn/en/</a>
Water China 2014	3-5 MAR 2014	China Import and Export Fair Complex, <b>Guangzhou</b> , PR China	Water Reuse Technique & Equipment - Terminal Water Purifier Technique & Equipment - Fluid Automation & Automatic Control Equipment - Service & Others	<a href="http://www.waterchina-gz.com/en/index.html">http://www.waterchina-gz.com/en/index.html</a>
Trade Fair for Water Treatment Technology Sector	20-22 MAY 2014	Shanghai new international expo centre, <b>Shanghai</b> P.R.C.	1. Water and Sewage 2. Membrane and Fittings 3. Usage 4. Measurement, Process Control and Laboratory Techniques	<a href="http://water.ie-expo.cn/en/">http://water.ie-expo.cn/en/</a>
Aquatech China 2013	25-27 JUN 2014	Shanghai World Expo Exhibition & Convention Center <b>Shanghai</b> , China	Research and Consultancy Water utilities and country pavilions management Water Treatment Process control technology & process automation	<a href="http://www.aquatechtrade.com/china/visitors/pages/default.aspx">http://www.aquatechtrade.com/china/visitors/pages/default.aspx</a>

## **APPENDIX 27: LIST OF CONTACTS (GOVERNMENT & COMPANIES)**

Ningbo Government Officials

*Confidential Contents*

Guangzhou Government Officials

*Confidential Contents*

Shanghai Government Officials

*Confidential Contents*

Ningbo Water Meter Companies

*Confidential Contents*

Shanghai Water Meter Companies

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Guangzhou Water Meter Companies

*Confidential Contents*